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Cysts of the Semilunar Cartilage of the Knee-Joint

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CYSTS of the semilunar cartilages are rare. The first descriptions are usually credited to Ebner (1904) and Schmidt (1906). As far back as 1883, however, the Frenchman Nicaise published an account of a multilocular cyst of this type, and in 1900 Ernberg described a case of a cyst situated at the fibulotibial joint. In 1916, Riedel wrote of 6 instances of cysts of the semilunar cartilage. In 1927 Kleinberg was able to trace 20 cases in the literature available; and in 1949 T. Borg had collected 71 cases, in 54 of which the diagnosis had been verified at operation and in 36, moreover, by subsequent microscopic examination. In 1953, Bonnin published a comprehensive report of 29 of his own patients, with a total of 31 cysts. As to the incidence of cysts of the semilunar cartilages, Sjövall of Sweden, referring to 875 arthrotomies from the University Clinic in Lund, has pointed out that they occurred in only 1 per cent of the total number of arthrotomies of the knee joint.

Owing to the relative infrequency of this condition, it seems appropriate to report 2 further cases, presenting almost identical features, which have come under my own observation and in both of which

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the patients were treated successfully.

Etiologic and Pathogenic Background.—The cause and pathogenesis are obscure; several theories have been advanced, but no final conclusion has yet been reached.

Congenital inclusions of synovial rests have been blamed for the development of these cysts — a theory that was first advanced by Ollerenshaw; other authors (Willard and Nicholson, Zadek and Jaffee) later came to the same conclusion. Chronic infection has also been held responsible for the development of the cysts (Jean).

With regard to the causal relation between the development of these cysts and *vascular abnormalities*, Ebner, as far back as 1904, described an obliterating type of endarteritis of the small arteries of the capsule, though other authors have been unable to confirm this finding.

There appears to exist a certain relation between the formation of cysts of the semilunar cartilage and *trauma*, as a considerable number of records mention an antecedent injury. Some authors, however (Blanco, Marano and Postoloff), consider the traumatic theory "highly speculative." The frequency of antecedent trauma is given by Bonnin as one-third of the cases, by Jean as 45 per cent and by Allison and O'Connor as half the cases. Sjövall placed the frequency at 55 per cent, and Borg reported that an antecedent trauma had been established in 21 of the 54 cases in which operation was performed. It is remarkable that, in 3 cases of the 6 reported by Lidström which came before the Insurance Mediator's Board, this institution decided that an accident within the meaning of the insurance laws had occurred in these 3 cases. One of the patients under consideration here (Case 1) also had a history of an antecedent trauma — a severe one, with fracture and, moreover, rupture of the semilunar cartilage, whereas the patient in Case 2 denied having undergone any preceding injury. Since this has been observed in such a considerable number of cases, it is impossible to deny the significance of trauma, and the relation between a torn cartilage and cyst formation is of great interest. At an autopsy, Lindblom demonstrated a rupture of the anterior part of the lateral semilunar cartilage, ending in a ganglion at the most anterior capsular attachment. It is remarkable that cysts of the external meniscus have been shown to be three times as frequent as are cysts of the medial semilunar cartilage: Bonnin's account includes 7 medial and 24 lateral meniscectomies, as the medial semilunar cartilage is injured approximately six times as frequently as the lateral. Some authors (Bristow; Phemister) have held the slight inward angulation at the knee responsible for the higher frequency of degenerative cysts of the lateral meniscus, as it causes greater pressure on the outer side of the joint. This theory, however, has been gainsaid by Taylor, who pointed out that "this inward angulation is greater in women than in men, and yet the incidence of cysts in the menisci is less in women than in men." Taylor found an explanation in the fact that the lateral cartilage is more exposed to direct trauma than is the medial, and if in cases of cysts in the internal cartilage a trauma has been reported, it has been a direct blow on the medial side of the knee.

Concerning pathogenesis and the mechanism of the trauma, even the first authors to publish cases of this type of cyst suggested that the cyst formation depended on a hernial protrusion of the synovial membrane (Nicaise; Ernberg).

With regard to the mechanism of the trauma, Jean expressed the opinion that the trauma caused a hemorrhage into the meniscus, a "hémorrhagie intrameniscale" from which the cysts develop. Taylor also pointed to a contusion of the semilunar cartilage, followed by mucoid degeneration

of the cartilage; he emphasized the "mildness" of the trauma as an essential factor in the development of the cysts. An incomplete transverse or oblique tear, the "parrot-beak tear," is associated particularly with cystic degeneration (Smillie). Concerning the mechanism of the trauma, Smillie, who has also pointed to the significance of the rotary trauma, offered an interesting explanation: as a definite history of a direct kick over the joint line is recorded in a number of these cases and it is not improbable that this direct kick on the convexity forces the meniscus towards the center of the joint; and, as the lateral meniscus is tightly gripped between the femur and the tibia, it cannot fold or buckle, and a transverse tear may result. In 1 of my own cases, however (Case 1), the antecedent trauma was a severe one, with fracture and a torn cartilage. The ability of the semilunar cartilage to regenerate after trauma seems to be an important factor in this connection, and it may be worth while to draw attention to Fisher's description of the nourishment of the menisci. Fisher described how the outer third of the semilunar cartilages derives its nourishment from blood vessels entering the cartilage from the periphery, whereas the inner two-thirds derive their nourishment from the synovial fluid. He observed that in transverse tears of the semilunar cartilages the outer third heals by dense fibrous tissue, while the inner third fails to heal at all. It is also known that regeneration of the semilunar cartilages after meniscectomy can take place from the periphery, with the formation of new meniscus.

That degenerative changes in the meniscus play a very important role in the development of the cysts has been emphasized by most of the authors who have concerned themselves with these cysts (Bristow; Campbell and Mitchell; Fisher; Phemister; Taylor), and attention has been drawn to the similarity between these cysts and ganglions in other sites. Colloid degeneration of the fibrocartilage (Allison and O'Connor; Borg; Kleinberg) has even been termed "méniscite chronique pseudokystique" by Jean. Allison and O'Connor concluded that the degenerative changes were the end result of interference with the blood supply of the cartilage. These authors also found it reasonable to assume that the trauma may act as an eliciting factor, but they emphasized the point that such an assumption cannot explain the evident progressive degeneration of the semilunar cartilage over a period of months, or even of years, after the injury. Kleinberg, too, came to the conclusion that the cysts arise from the cartilage and represent the end result of a degenerative process starting in the cartilage; defects appear in the middle of the meniscus, either through some kind of injury or perhaps through disturbances of the metabolism of the cartilage cells; these cells become necrotic; the defects develop into vacuoles, which coalesce, enlarge and become cysts.

Pathologic Picture.—The cyst is firmly attached to the meniscus and extends into it. Microscopic examination shows that the cyst consists of a lining membrane made up of fibrous connective tissue, which contains a few scattered cells and deposits of fibroid material with degenerative changes (Fig. 1). The cyst usually contains mucoid, or slightly blood-tinged material. The cyst may be unilocular, or, as in most cases, multilocular, separated by fibrous septums; there is, however, no reason to distinguish between unilocular and multilocular cysts, as several authors have done. Far more important from a pathogenetic point of view is the problem as to whether the wall is lined by a membrane of epithelial or endothelial tissue. This has long been a matter of controversy. Ollerenshaw, Willard and Nicholson and

Zadeck and Jaffee claimed that they observed an endothelial lining, but most authors have been unable to confirm this observation (Ebner; Allison and O'Connor; Campbell and Mitchell; Jean).

In neither of the 2 cases here reported was an epithelial or an endothelial lining observed; degenerative changes, however, were pronounced, and the cavities were lined with degenerated cartilage tissue.

Clinical Features. — The condition is usually encountered in young adults (Blanco; Marano and Postoloff; Sjövall; Smillie; Bonnin; Taylor). There are, however, cases on record of children—a 5-year-old (Campbell) and a 6-year-old (Colonna)—with such a cyst of the semilunar cartilage, and in the cases here presented the patients were men aged 51 and 64 respectively. The lesion most frequently occurs in males; Bonnin's account includes the cases of 22 male and 7 female patients.

The cyst usually appears as a swelling located at the middle portion of the affected cartilage. It may also be situated anteriorly or posteriorly; these locations are rarer. According to Bonnin's account of 31 cysts, 24 were located at the "classic" site, while 3 were located anteriorly and 4 posteriorly. The swelling usually grows slowly for several years, as in Case 2; it may, however, reach its maximum size quickly and then remain stationary (Allison and O'Connor), as it did in Case 1. The cysts may be painful or painless. Hayek emphasized "lancinating pain" as an early and frequent symptom, observed in his 2 cases, in which the pain did not disappear until four or five weeks after removal of the cyst. The patient may also complain of insecurity of the knee joint (Blanco; Marano and Postoloff). Bonnin, Blanco, Smillie and Marano and Postoloff also mentioned pain (particularly after exercise and athletic activity) relieved by rest, but a number of Bonnin's patients stated that the pain was worse at night. Bonnin further mentioned active pain in the knee joint, which was referred by the patient "with accuracy and precision" to a small area on the joint line.

A symptom not mentioned in the available literature is a paresthetic sensation in the region of the peroneal nerve, caused by compression of this nerve; this symptom was very pronounced in Case 1, and it is remarkable that it disappeared immediately the tumor was removed.

The mass may be firm or semifluctuating. It is not reducible, but its size may vary with different positions of the knee, being larger with the limb extended (Sjövall). Pisani considered complete disappearance on acute flexion a pathognomonic sign, which he termed the "disappearing sign"; it was observed by him in 31 instances. The cyst may or may not be tender to firm pressure. The movements of the joint are usually normal, apart from slight pain or tenderness on extreme flexion or extension of the limb (Allison and O'Connor), as in Case 1. The movements of the limb may also be completely free and painless, as in Case 2. It is a characteristic feature that the mass moves only with the movements of the tibia.

A unique and extremely interesting case has been reported by Wijnbladh. In this case there was a lump on the anterior side of the tibia, which recurred after removal; at reoperation it proved to be a cyst of the medial semilunar cartilage. A stem 20 cm. long connected the mass with the degenerated meniscus, which was also removed. Wijnbladh called it "a migrating ganglion."

The ordinary roentgenogram of the knee joint is completely normal except for the shadow that may be revealed in the soft parts. A roentgenogram after insufflation of air into the knee joint in cases of severe involvement reveals a horizontal

fissure in the semilunar cartilage (Fig. 2).

Treatment and Prognosis. — Proper treatment consists in operation, with excision of the cyst and the semilunar cartilage or part of it. It is advisable to remove the meniscus and the cyst *en bloc*, as was done in Case 1; this may be a complicated procedure, as part of the synovial membrane must be sacrificed in some cases. Removal of part of the cartilage may prove sufficient, especially when the cyst is attached to the anterior part of it (M. Thorek). In some cases Smillie has used an additional posterior incision.

Most authors agree that the removal of the semilunar cartilage, or part of it, is necessary if recurrence is to be avoided with certainty (Allison and O'Connor; Borg; Riedel; Taylor). In the case described by Schmidt in 1906 it was remarkable that the condition recurred twice after simple removal of the cyst; when, at the third operation, the semilunar cartilage too was removed, the condition was cured. Simple excision of the cyst without removal of the meniscus may also prove sufficient to insure a favorable result (Sjövall), as it did in Case 2, but the more radical surgical procedure is to be preferred.

After complete removal, recovery with no recurrence may be expected, as in the 2 cases under review, in which the postoperative period of observation extended over several years: ten in Case 1 and two in Case 2.

REPORT OF CASES

CASE 1. — A 51-year-old man had had an accident resulting in fracture of the left femur and tibia four years prior to entering the hospital. The fracture healed after proper treatment. Subsequently a node developed at the level of the head of the left fibula; the node was fairly painful, and there were slight paresthetic sensations in the peroneal region. Massage had only a slight effect on the pain. The node remained unchanged, and the pain returned.

On admission a soft, tender, flat node the size of a prune was palpated at the level of the head of the left fibula; it was adherent in the deep tissues but not to the skin; it was not reducible. Except for pronounced tenderness at the site of the node when the knee was fully flexed, the movements of the knee were normal and caused no pain. There was slight hypersensitivity in the peroneal region. There was no atrophy of the peroneal muscles.

Routine examination revealed no abnormality. The blood pressure in millimeters of mercury was 100 systolic and 75 diastolic. Roentgen examination of the left knee joint by air insufflation revealed a fissure of the lateral semilunar cartilage (Fig. 2).

Operation was performed (J. H.). An incision was made through the skin and fascia; the hygroma, which was multilocular, was isolated; the lateral semilunar cartilage and the hygroma were extirpated *en bloc*, isolation being effected from the internal surface of the capsule to avoid damage to the peroneal nerve, which must have been lying close to the hygroma and was probably compressed by it. Part of the lateral collateral ligament was sutured with interrupted silk sutures; the

Fig. 1 (Case 1).—Cyst of the semilunar cartilage and the attachment to the meniscus. Pronounced degenerative changes, with formation of vacuoles and cystic cavities, can be seen. There is no evidence of any epithelial or endothelial lining.

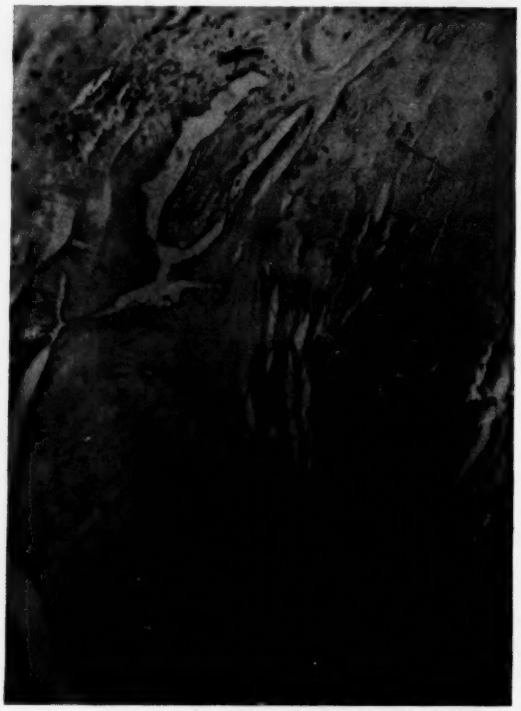

Fig. 2 (Case 1).—Roentgenogram of cyst of the semilunar cartilage, revealing a fissure in the lateral meniscus.

capsule with catgut, and the skin with silk. The postoperative course was uneventful. The paresthesias in the peroneal region disappeared immediately after the operation.

Microscopic examination showed a semilunar cartilage with scattered, pronounced degenerative changes. Edema, vacuolization, dissolution and crumbling of the fibrils were observed, as well as unmasked areas of the tissue. Scattered narrow cystic cavities lined with cartilaginous tissue presenting degenerative changes were observed. There was no evidence of any endothelial or epithelial lining of the cavities. Macroscopically it was seen that a mass was firmly attached to the border of this meniscus. Microscopic examination showed that this mass consisted of lamellar fibrous tissue, poor in cells, surrounding smaller cystic cavities lined by tissue with pronounced degeneration. There was no evidence of any endothelial or epithelial lining of the cavities. A synovial epithelium covered part of the specimen. In the adjacent structures very slight unspecific inflammatory changes were evidenced. The microscopic diagnosis was degenerative change in the semilunar cartilage, with a so-called "ganglion" attached (Fig. 1).

At reexamination the patient was still feeling well, and there has been no recurrence during a follow-up period of ten years.

COMMENT

This case illustrates how a cyst of the lateral semilunar cartilage may develop after a severe injury to the knee joint. The cyst had caused sensations in the region of the peroneal nerve, probably on account of compression of this nerve. The roentgenogram revealed a fissure in the semilunar cartilage. Operation, including complete removal of the cyst and the meniscus *en bloc*, brought about recovery during a postoperative observation period of ten years. On microscopic examination the relation of the cyst to the semilunar cartilage was ascertained, but there was no evidence of an epithelial lining in the cystic cavities.

CASE 2.—A 64-year-old man had for some time noticed a swelling on the lateral border of the right patella. There was no history of antecedent trauma, and there had been no pain. The node had slowly increased in size during a nine-month period of observation.

On admission, a comparatively soft node the size of a pea was palpated in the region of the lateral border of the right patella. The node was not reducible. There was no tenderness of the node, which was adherent in the deep tissues but not to the skin. Movements of the knee were normal and without pain. The results of routine examination were essentially negative. The blood pressure in millimeters of mercury was 135 systolic and 50 diastolic. Roentgen examination of the right knee revealed nothing abnormal. Examination by means of air insufflation was not performed.

Operation was performed (J. H.). A curved incision was made through the skin and fascia at the lateral border of the patella. A multilocular hygroma was isolated with some difficulty. A communication to the knee-joint cavity of the thickness of a pencil was ob-

served at the lateral meniscus. The hygroma was removed completely. The communication was sutured and the meniscus *in situ*. The fibrous capsule was closed with interrupted catgut sutures, and the skin with silk. Except for slight hemorrhagic oozing, the postoperative course was uneventful.

Microscopic examination revealed that the tissue removed consisted of lamellar fibrous tissue with degenerative changes, vacuolization and smaller cystic cavities, which in places coalesced, forming larger cavities lined by tissue with marked desquamation. There was no evidence of any epithelial or endothelial lining of the cavities. The microscopic diagnosis was so-called ganglion.

COMMENT

This case illustrates an apparently spontaneous development of a cyst of the lateral semilunar cartilage and, in addition, the manner in which surgical intervention, with removal of the cyst, brought about recovery during a postoperative observation period of two years. Microscopic examination failed to demonstrate the presence of any epithelial or endothelial lining of the cysts.

SUMMARY

After a survey of the frequency of cysts of the semilunar cartilages of the knee joint, the author gives an account of the different theories about the etiologic background and pathogenesis of this condition. The pathologic picture, the clinical features and the treatment are outlined, and 2 illustrative cases are reported.

ZUSAMMENFASSUNG

Nach einer Untersuchung der Häufigkeit des Auftretens von Zysten in den Menisken des Kniegelenks berichtet der Verfasser über die verschiedenen Theorien des ätiologischen Hintergrundes und der Pathogenese dieser Erkrankung. Das pathologische Bild, die klinischen Erscheinungen und die Behandlung werden beschrieben. Zwei erläuternde Fälle werden berichtet.

RÉSUMÉ

Après avoir donné un aperçu de la fréquence des cystes du cartilage semilunaire du génou, l'auteur explique les différentes théories de l'étiologie et pathogénèse de cette condition. L'image pathologiques, les symptomes cliniques et le traitement sont expliqués et deux cas illustratives sont reportées.

RESUMEN

Después de una encuesta para determinar la frecuencia de los quístes de los cartílagos semilunares de la rodilla, el autor da una relación de las diferentes teorías acerca del fondo etiológico y patogenesis de este padecimiento. Se mencionan la imagen patológica, los hallazgos clínicos y el tratamiento y se comunican 2 casos ilustrativos.

SUMARIO

Após uma investigação sôbre a freqüencia dos cistos das cartilagens semilunares da articulação do joelho, o autor apresenta as várias teorias sôbre as bases etiológicas e patogenéticas desta afecção. O quadro pãtológico é delineado, bem como os dados clínicos e o tratamento, sendo apresentados dois casos.

RIASSUNTO

Dopo una rassegna sulla frequenza della cisti della cartilagine semilunare del ginocchio l'autore espone le varie teorie sull'etiologia e sulla patogenesi di tale affezione, et ne descrive il quadro anatomopatologico, clinico e la cura. Vengono presentato due casi dimostrativi.

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Wisdom is the perfect good of the human mind; philosophy is the love of wisdom and the endeavor to attain it.

—*Seneca*

To be a philosopher is not merely to have subtle thoughts, nor even to found a school, but so to love wisdom as to live according to its dictates, a life of simplicity, independence, magnanimity, and trust.

—*Thoreau*

Fractures of the Femoral Neck

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ABOUT fifteen years ago Kellog Speed delivered a lecture on the "unsolved fracture." At that time the Smith-Petersen nail, multiple pins, the lag screw and many other varieties of hardware were in active use. Dr. Speed's paper was politely accepted as the offering of an elderly medical statesman. One of us, a former student of Dr. Speed's, should have realized that this illustrious surgeon did not often speak lightly. The passing of the years has shown how timely was his message and how he tried in vain to guide younger surgeons away from the false illusions created by a multiplicity of unproved procedures.

In 1953 Dr. James A. Dickson, in a presidential address given before the American Orthopedic Association, protested against defeatism. The unsolved fracture was still an enigma. Much had been learned; progress had been great, but poor end results still plagued most orthopedic surgeons. Dr. Dickson presented several case reports on patients who had had preliminary care with the Whitman plaster, the Thomas splint, the lag screw, multiple pins, a Smith-Petersen nail and the Jewett nail; and, regardless of the method used, nonunion had occurred. After being treated with bone grafts or combined osteotomy and bone grafts, all of the patients presented by Dr. Dickson obtained almost normally functioning hips, with no pain or limited motion and no limp. Today most of these patients would have been considered candidates for hip prostheses. Dr. Dickson further protested the use of untested materials, nonphysiologic procedures and immature judgment.

The "unsolved fracture" will not be solved through a series of minor attacks. An all-out effort combining the talents of engineers, anatomists, physiologists and surgeons will be needed.

Retrospection, when repeated, often brings to light information which one has thought to be new and advice which, had it been heeded, might have changed the course of many disastrous cases. Pauwels thoroughly studied the mechanics of fractures of the femoral neck. He warned of the poor prognosis to be expected of Type 2 and Type 3 fractures, or fractures in which the angle of fracture was between 30 to 60 degrees and 60 to 90 degrees respectively. Pauwels further suggested that the Type 3 fracture might require additional care — perhaps bone grafting. In 1945 the South American literature contained several articles in which excellent results in fairly large series of cases were reported. In all of these cases bone grafts had been inserted during the period of initial surgical treatment.

Senn, in 1901, stated that if bone ends can be placed in perfect apposition, union by bone will take place. Time has proved Senn somewhat overenthusiastic, but it was his work that laid the foundation for the development of the Smith-Petersen tri-flanged nail and the recognition of the need for better roentgen technic to show the hip in the lateral as well as the anteroposterior positions. Phemister, Wolcott, Whitman, Abbott, Johannson, Linton, McElvenny, Leadbetter and dozens of

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others have contributed information that has been responsible for the virtual elimination of the high mortality rate that attended fractures of the femoral neck in the early 1900's and for the increase in union from 10 per cent to the 60 or 70 per cent level.

There have been many excellent case reports in the recent literature and another such report would serve no useful purpose. We have therefore made a critical analysis of over 400 cases of fracture treated in several centers and at our own institution. This study has brought out some common misconceptions and also demonstrates a frequent failure to recognize or look for obvious pathologic features. We have classified the fractures into three groups: (1) fractures without displacement; (2) fractures with displacement, and (3) fractures that healed but were later followed by avascular necrosis of the femoral head.

1. *Intracapsular Fractures of the Femoral Neck Without Displacement.*—Fractures without displacement usually are classified as Type I Pauwels (one in which the angle of fracture varies from 0 to 30 degrees). Pauwels and many other surgeons considered this an impacted fracture that can well be handled by conservative treatment, either with the use of traction or by the application of a short leg cast to which a bar has been added to prevent rotation. If the fracture is incomplete it can be so held; but more often, after ten days of absorption, a more complete fracture line is often visible, and displacement may be brought about by an overzealous attendant who rolls the patient but forgets to include the cast and bar. The treatment should, in our opinion, consist of maintenance of position by avoidance of unnecessary handling or manipulation and the insertion of one or two screws. The use of a tri-fin nail may carry with it the danger of displacing the fragments as the nail is being inserted. It has not the advantage, therefore, that two screws provide.

2. *Fractures with Displacement.*—Fractures with displacement require manipulation in order to secure anatomic restitution to an adequate degree. As to what constitutes adequacy there is some disagreement. Some insist on complete anatomic realignment; others, including ourselves, demand only good apposition and bony contact in a mechanically stable position. If commi-

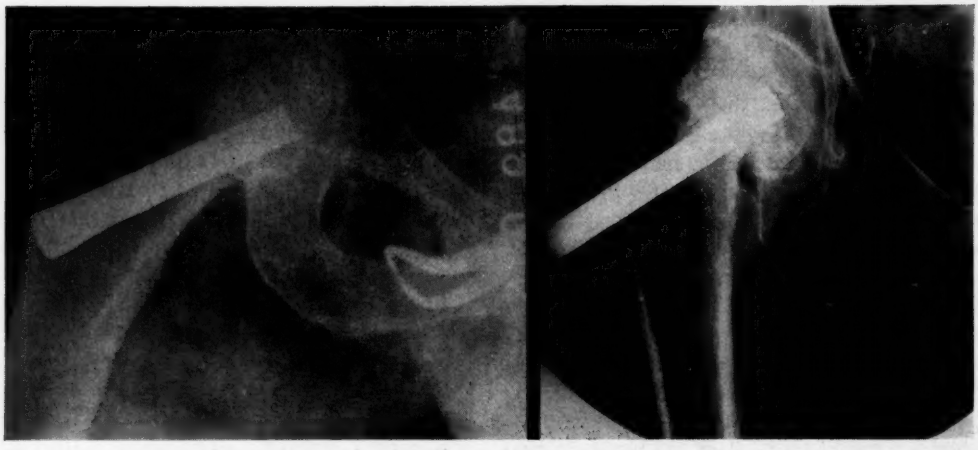

Fig. 1.—*Left,* Hip nailing. Operating room film, taken Jan. 20, 1953. *Right,* film taken six weeks later. Settling has occurred. The femoral head has gone into varus.

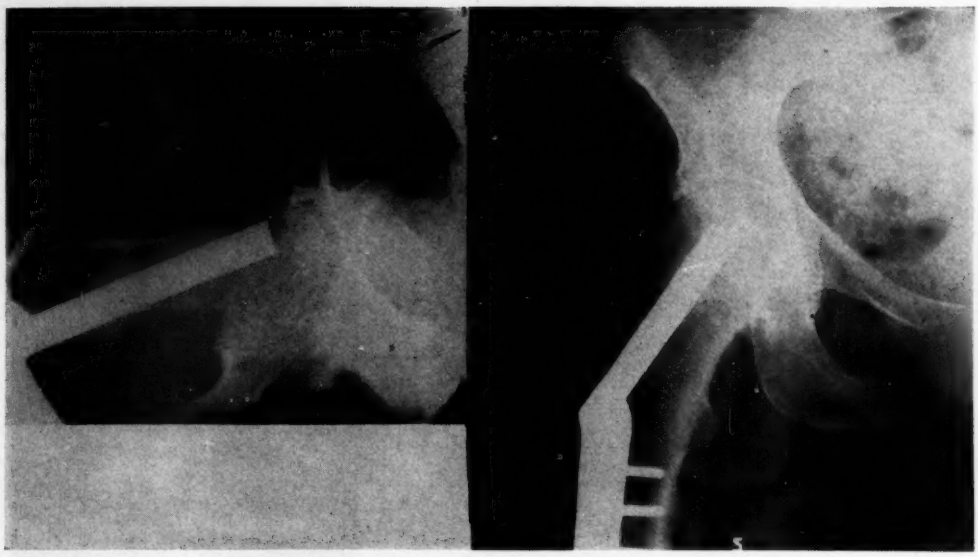

Fig. 2.—Operating room film taken after Jewett nail fixation.

nution is present or an adequate reduction cannot be obtained after two or three attempts, an open exposure of the fracture site is indicated. Comminuted fragments may be replaced and a graft applied, after which the tri-fin nail is inserted under direct observation. Routine open reduction and exposure of the fracture site is not recommended. Cleveland reported an increase in the incidence of nonunion as resulting from such a routine. Tri-fin nails, multiple pins or screws may be used for fixation and should be inserted away from the upper one-third of the head. Stability may be enhanced by proper positioning of the mechanical fixer, and disturbance of helpful intramedullary bone structure will not occur. Several papers have been published or are about to be published in which the authors recommend the use of a Jewett nail or a nail fixed to the cortex of the shaft. A careful study of all fractures of the neck of the femur will reveal, six to twelve weeks after the operation, a "settling" phase, in which there may be a shift to varus or valgus. A shift to the former position may be disastrous if weight bearing is begun too soon or if the extremity is allowed free flexion and external rotation too early. The nail, which cannot now protrude laterally, can only go in one of two directions: either through the head into the acetabulum or cut through the neck, to be drawn superiorly. If the fracture has been properly immobilized by a tri-fin nail, multiple pins, or screws, the lateral displacement of the pin which develops as settling occurs can be observed, and prompt action by one of the osteotomies or bone grafting procedures can be instituted. Settling apparently occurs in practically all cases and varies from a few millimeters to more than a centimeter. Settling, plus a shift to valgus, need cause no alarm, but a shift toward varus suggests disaster and calls for intervention. The prompt recognition of the indications for palliative operation cannot be overemphasized. A viable head is always pref-

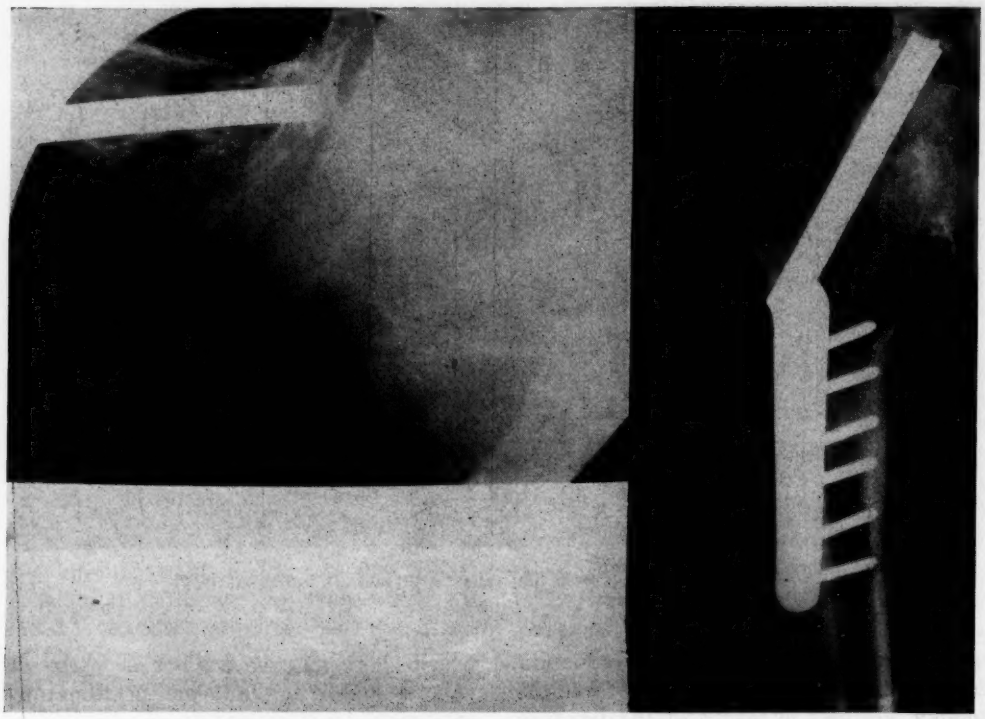

Fig. 3.—View taken twenty-one weeks after the operation, showing protrusion of nail into the acetabulum after shortening of the femoral neck.

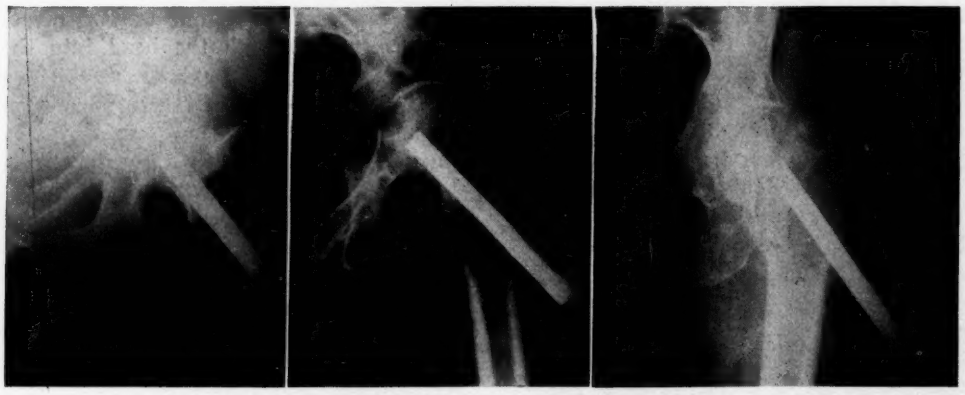

Fig. 4.—Progressive extrusion of nail following shortening of femoral neck.

erable to a prosthesis. In a large majority of the cases of early nonunion, viability may be preserved and union of the fracture site brought about by intelligent and exacting application of the principles for corrective osteotomy as laid down by

Blount and Dickson. The use of a Jewett nail in fractures of the neck is an inadequate mechanical answer to a problem that calls for a physiologic attack. The Jewett type of nail often complicates the problem.

3. *Avascular Necrosis.*—Unfortunately, this serious complication, which occurs in about 25 per cent of the cases of healed fractures, presents itself eighteen to thirty months after the fracture has healed. By careful roentgen studies of the density of the femoral head, the first sign of avascular necrosis may be recognized at about nine months after the fracture. Discomfort on weight bearing is suggestive, but the presence of a new break in the continuity of the head is conclusive evidence of the need for a preliminary period of complete freedom from weight bearing, or for bone grafting. Secondary deforming articular changes may develop as a consequence of failure to recognize the early necrosis. Rest and/or bone grafting can be expected to help in 25 per cent of these cases. In 75 per cent, however, the necrosis goes on to complete destruction of the head. It is in cases of this type that the use of prostheses finds the widest application.

Avascular necrosis is unpredictable. On the basis of current knowledge one cannot measure the extent of damage to the blood supply, nor can one prognosticate with any degree of certainty. This is an unsolved element in the complicated multifaceted physiologic problem of fracture of the neck of the femur.

If a solution is to be found—and in our opinion it will be in the near future—we are certain that the answer will not be forthcoming from the development of further physical research. One must not confuse the physical with the physiologic. If a small part of the energy now being expended in the development of new prostheses and modification of other hardware could be devoted to the problems of circulation in the head and neck of the femur, to bone metabolism and repair, to calcium and phosphorus metabolism and to other related anatomic and physiologic problems, the solution might be closer at hand. What is needed are the answers to such questions as: Does any blood supply come into the adult femoral head through the ligamentum teres? Does the head need a new blood supply, or does it require drainage? Will the use of muscle flaps bring in the blood supply or provide drainage? How may the radioactive isotopes be used to study metabolism in bone? Venable and Stuck, Trueta, McNabb and others, including ourselves, have explored and will continue to explore this fascinating field for the answers.

SUMMARY

The application of good surgical principles, such as early operation when the patient is medically sound and shows no obvious renal or cardiac failure, has almost eliminated immediate postoperative mortality. Intelligent use of the proper materials for fixation and careful postoperative supervision has been responsible for an increase in the incidence of union, but little has been accomplished toward helping the orthopedist to predict the development of avascular necrosis in any given case, or toward the prevention and proper treatment of this crippling complication. The so-called nondisplaced fracture must be watched carefully and is best treated by fixation with screws. The displaced fracture requires sound medical handling and an equally sound surgical approach. The importance of the settling phase must not be overlooked, and it should be realized that in the use of various types of prostheses, the physiologic response will completely alter some of the mechanical advantages demonstrated by the prostheses on dead bone and in wood. The unsolved problem of avascular necrosis calls for early recognition and the

equally early intervention by palliative procedures that tend to preserve the bone rather than to remove it by amputation. A greater interest in basic research is needed. The problem was recently summed up admirably by Eggers: "There is no physiology in the knife blade."

ZUSAMMENFASSUNG

Die Anwendung vernünftiger chirurgischer Grundsätze, wie z. B. die frühzeitige Einleitung operativer Massnahmen bei innerlich gesunden Patienten ohne offenkundige Nieren—oder Herzschädigungen, hat die unmittelbare postoperative Sterblichkeit fast völlig ausgeschaltet. Intelligente Anwendung des geeigneten Fixierungsmaterials und sorgfältige Überwachung nach der Operation haben zu einem Anstieg des Prozentsatzes erreichter knöcherner Heilung geführt. Dagegen ist noch nicht viel geleistet worden, was die Voraussage, in welchen. Fällen eine avaskuläre Nekrose zu erwarten ist, erleichtern, oder zur Verhütung und erfolgreichen Behandlung dieser verstümmelnden Komplikation von Nutzen sein könnte. Der sogenannte nicht verschobene Knochenbruch muss sorgfältig beobachtet werden und wird am besten mit der Fixierung durch Schrauben behandelt. Der Bruch mit verschobenen Fragmenten erfordert vernünftiges medizinisches und chirurgisches Vorgehen. Die Bedeutung des Heilungsstadiums bei diesen Knochenbrüchen darf nicht übersehen werden, und man muss berücksichtigen, dass bei Anwendung verschiedener Arten von Metallwaren die physiologische Reaktion manche der mechanischen Vorzüge, die das Metall am toten Knochen oder am Holz aufzuweisen hatte, völlig verändert. Die Behandlung der noch durchaus problematischen avaskulären Nekrose verlangt eine frühzeitige Diagnose und eine ebenso frühzeitige Anwendung palliativer Massnahmen, die eher auf eine Erhaltung des Knochens als auf seine Amputation gerichtet sind. Es bedarf weiterer vereinter Kräfte der grossen Organisationen, das Interesse an grundlegender Forschungsarbeit anzufeuern. Zum Schluss wird eine kürzlich von Eggers geäusserte Bemerkung zitiert: "Die Schneide des Messers kennt keine Physiologie."

RÉSUMÉ

L'application des principes chirurgicaux, c'est à dire l'opération précoce, quand le malade est en bonne condition et son coeur et ses reins fonctionnent bien, a presque éliminé la mortalité postopérative immédiate. Grace a l'élection intelligente des matériaux pour fixation et au bon soin postopératif les cas d'union sont plus nombreux, mais jusqu'à présent on n'a pas su prévoir les cas en quels une necrose avasculaire va se développer ou comment prévenir et bien traiter cette maladie, qui rend les malades infirmes. La fracture sans déformité doit être bien observée et le meilleur traitement serait celui par fixation avec des vis. Les fractures déformées seront traitées suivant propres méthodes medicales et chirurgicales. Il ne faut pas oublier l'importance de la phase de consolidation dans ces fractures et il faut se souvenir que malgré l'usage de toutes sortes d'utils en fer, l'action physiologique peut abolir complètement une partie des advantages mecaniques qu'on a vu en se servant de ces utils à l'os mort ou à du bois. Le traitement du problème pas résolu de la necrose avasculaire demande la récognition et intervention précoce plutôt par l'usage des procédures palliatives pour conserver l'os au lieu de l'enlever par une amputation. Il faut que cette grande organisation continue de collaborer avec des autres, pour stimuler plus d'intérêt en recherche fondamentale. Nous finissons en citant un resumé dernièrement fait par Eggers: "Il n'y a pas de la physiologie dans la lame du couteau.

RIASSUNTO

L'applicazione di esatti principi chirurgici, quali l'intervento precoce quando non vi siano segni di insufficienza cardiaca o renale, ha pressochè eliminato la mortalità operatoria. L'impiego intelligente di materiali di fissazione appropriati e le cure post-operatorie hanno migliorato la percentuale di guarigioni, ma ancora non è possibile prevedere in quali casi comparirà una necrosi avascolare nè è possible prevenire o curare tale spiacevole complicazione. La cosidetta frattura senza spostamento deve essere considerata con attenzione, e la cura migliore è rappresentata dalla fissazione con viti. La frattura con spostamento richiede un trattamento accurato cosí medico come chirurgico. Non si deve sottovalutare l'importanza della ricomposizione in tali fratture e bisogna ricordare che l'impiege dei vari tipi di metalli determina delle risposte fisiologiche che non compensano i vantaggi meccanici di tali materiali.

La cura della necrosi avascolare è problema ancora insoluto, che richiede una diagnosi precoce e un precoce intervento con mezzie palliativi piuttosto che ricorrere all'amputazione.

E' necessario continuare nelle ricerche. Noi ci associamo a Eggers che recentemente ha affermato che "non vi è fisiologia sulla lama del bisturi."

SUMARIO

A aplicação de bons princípios cirúrgicos, tais como cirurgia precoce quando. o paciente está clínicamente são, sem insuficiência cardíaca renal ou cardíaca evidente, pràticamente eliminou a mortalidade pós-operatória imediata. O uso de materíais adequados para a fixação e a supervisão pós-operatória cuidadosa têm sido responsáveis pelo aumento da incidência da união, mas pouco se tem conseguido até esta data para que se possa prever quais casos possam vir a apresentar necrose avascular, ou como se poderá evitar e tratar adequadamente esta complicação. A chamada fratura sem deslocamento deve ser cuidadosamente observada, sendo melhor fixada pelo uso de parafusos. A fratura com deslocamento exige tratamentos clínico e cirúrgico rigorosos. O tratamento do problema ainda não resolvido da necrose avascular exige reconhecimento precoce e intervenção igualmente precoce pelo uso de processos paliativos que tendam a preservar o osso e não a removê-lo por amputaçao. Esta grande organização deve continuar a unir-se com outras com o fito de estimular maior interêsse na pesquiza básica. Em conclusão, o autor cita a assertiva de Eggers "Não há fisiologia nalâmina de uma faca."

RESUMEN

La aplicación de buenos principios quirúrgicos tales como el tratamiento quirúrgico precoz cuando el paciente no presenta padecimiento renal o cardíaco casi ha eliminado la mortalidad postoperatoria. El uso de los materiales apropiados para la fijación y la supervisión postoperatoria adecuada a aumentado la frecuencia de la consolidación; sin embargo poco se ha avanzado para predecir cuando un caso va a presentar una necrosis avascular o cuando se puede prevenir esta complicación invalidante para poder ser tratada. La llamada fractura no desplazada debe ser tratada cuidadosamente, obteniéndose los mejores resultados por la fijación interna por medio de clavos. El desplazamiento de la fractura requiere tratamiento médico y quirúrgico. No debe pasarse desapercibida la importancia de la fase de asentamiento en estas fracturas, las respuestas fisiológicas pueden alterar algunas de las ventajas mecánicas. El tratamiento del problema no resuelto de la necrosis avascular requiere un diagnóstico y tera-

peútica precoces, usando procedimientos paliativos que tiendan a conservar el hueso en vez de extirparlo por amputación. Esta organización debe unirse a otros con el objeto de estimular y crear un mayor interés en la investigación. En conclusión, citaremos lo establecido recientemente por Eggers: "No existe ninguna fisiología en el bisturí."

Greatness is a spiritual condition worthy to excite love, interest, and admiration; and the outward proof of possessing greatness is, that we excite love, interest, and admiration.

—Arnold

Greatness, after all, in spite of its name, appears to be not so much a certain size as a certain quality in human lives. It may be present in lives whose range is very small.

—Brooks

No great man lives in vain. The History of the world is but the Biography of great men.

—Carlyle

He alone is worthy of the appellation who either does great things, or teaches how they may be done, or describes them with a suitable majesty when they have been done; but those only are great things which tend to render life more happy, which increase the innocent enjoyments and comforts of existence, or which pave the way to a state of future bliss more permanent and more pure.

—Milton

He only is a great man who can neglect the applause of the multitude, and enjoy himself independent of its favour.

—Steele

Psychopathologic Aspects of Plastic Surgery

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ONE who operates on an appendix without knowing the patient's psychosomatic personality is an operator but not a surgeon. In the same way, one who corrects a scar on a face without knowing the psychic and ambient factors that affect the patient is a plastic operator but not a plastic surgeon. One ought not to consider any defect a new and independent process; it is a process that takes part in the evolution of the patient's entire personality.

These are the two fundamental premises upon which this article is based.

Picture a Greek lake and Narcissus at its border. The young man sees his image in the mirror of the water and admires it. Introvert as he is, he sees his soul, satisfies his senses and rejoices in his internal vision. This Hellenic myth explains a good many of the psychic problems confronting the plastic surgeon. This, however, is only one side of a very complex polyhedron; the surgeon must be endowed with sufficient penetration and analysis to interpret each facet and, therefore, proceed according to the individual case.

The wish to be or to seem physically agreeable is as old as the world. Primitive man used to paint himself. Naked bodies —man's and woman's—against the backdrop of nature in ancient Greece, won applause or were scorned by a people aesthetically trained. Warriors, cutting off the ears and noses of their defeated enemies, deformed them, depriving them of their beauty and so humiliating them. Throughout the centuries similar examples are to be found, which reveal the power of the senses in governing human nature.

Today this passion for physical perfection has found a basis for hope; plastic and reparative surgery, which can remodel nature's defects and embellish her less pleasing performances.

Not only narcissism, however, impels man toward an unattainable perfection: this desire may also be motivated by a natural wish to be agreeable, a natural shrinking from appearing repulsive.

The craving may be exaggerated, diminished or altered. The doctor, before giving advice, must know the psychic condition of his patient.

In any patient who is dissatisfied with his appearance a struggles takes place between the patient's eye and his *alter ego*, so to speak, the perfect self. And this inner struggle affects his life, his actions, and his behavior toward others, enlarging or restricting the entire field of his activity. A man with a little defect on his nose may be humiliated by his exaggerated idea of the physical imperfection and may change into a voluntarily misplaced person, since he changes his physical microtrauma into a psychic macrotrauma. A woman with a large pilose pigmentary mark covering her cheek may transcend, without the need of stoicism, her real ugliness and develop normally in society, since she changes her physical macrotrauma into a psychic microtrauma. The former is a dysmorphic person, a true narcissist; the latter a eumorphic person, a defender of her own ego.

A worker wanted to be a film actor (Fig. 1). A small defect on his nose pre-

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Fig. 1.—Preoperative and postoperative photographs of a patient with rhinokyphosis. A small physical defect had given rise to a great psychic defect.

Fig. 2.—Two "model" photographs of an actor, brought by the patient shown in Figure 1, who wished his nose reconstructed to match them.

vented him, so he said, from developing his work on the screen, and he showed me a "model" photograph (Fig. 2), asking me to construct him a similar nose. Once the operation had been performed, the man's equilibrium was reestablished.

A young woman had a pilose pigmentary mark. Without any urgency, she asked me for advice as to the possibility of improving the appearance of her cheek. After the operation (replacement of the pathologic skin by a dermatome graft) the patient's psyche adjusted itself, and there was no alteration at all in her iron character (Fig. 3).

The plastic surgeon must study his patient as a psychosomatic entity. He must penetrate the patient's psyche and ponder, pro and con, the results that may follow correction of the defect.

In some cases, of course, he may dispense with such a study, in view of the seriousness or the urgency with which steps must be taken. For example, a young man crashed with his plane in flames. As a result, his face and hands were deformed by horrible burns. Poorly cared for, they healed with frightful scars, which led him to consult me (Fig. 4). But here is the interesting thing in this case: the young man's psyche, notwithstanding the trauma he had suffered, had not lost its equilibrium; he was able to transcend the physical disabilities brought about by his deformity as well as the unjust punishment inflicted by society through imprudent and tactless comments. Since most of his deformities have been surgically corrected, the patient's social life is unmarred by any sense of inferiority.

Fig. 3.—Preoperative and postoperative profiles. The cosmetic effect of the plastic operation is apparent.

Fig. 4.—Loss of eyebrows and scalp; ectropy; chyloids on cheeks; loss of part of the nose and the cartilage of the ear; deformity of lips; chyloids and "bridles" on hands. Nothing could influence the patient's personality.

Still more interesting is a second patient of the same general type. A white woman 44 years old, of normal height, born in the State of Rio de Janeiro, stated that a black "mark" on the anterior cervical region and the anterior part of the thorax changed, when she was 18 years old, to red. Roentgen therapy, applied for four years, could not prevent the development of the tumor, which, growing in thickness and surface, invaded 80 per cent of the face (Fig. 5). This was a case of hemangioma, which Brazilian doctors had already treated in part.

It is a good case to demonstrate that psychosomatic medicine cannot always be applied as a means of correcting the severe psychic trauma brought about by a physical abnormality. An immense amount of readjustment was necessary to enable this seriously wounded psyche to arrive at some equilibrium.

As a third case I offer the photographic documentation, offered by Brazilian colleagues, of a young man with hemangiomas on his tongue (Fig. 6). His psyche was so altered that he lived in a permanent state of anxiety, constantly asking surgeons to correct his abnormality.

Successive operations removed part of the tumors, without, however, achieving any adjustment of the patient's anxiety.

In such cases physical life comes first in the decision adopted by the surgeon, who, to some extent, is freed of the necessity for psychoanalytic studies prior to an intervention of this kind.

Patients who try to hide their true reasons for calling on the plastic surgeon deserve another type of study. One who is accustomed to them recognizes them immediately. A woman 50 years old wished to have her facial wrinkles eliminated (Fig. 7*A*). Her history showed that her anxiety had begun after an operation for rhinomengaly had been performed on her daughter. Perhaps a hidden impulse of rivalry was born in her against her daughter's youth and beauty. From the way she linked her answers, the possibility could not be put aside. Moreover, the illusion that she intended "building" for others and the half-secret way in which she told me of the troubles brought about by her "premature old age" supported such a supposition.

I was thus confronted with a drama of menopause, or, more aptly, of the "seconde jeunesse," of which the French talk so much. "I never had any youth," said the patient, "and I have still a craving for

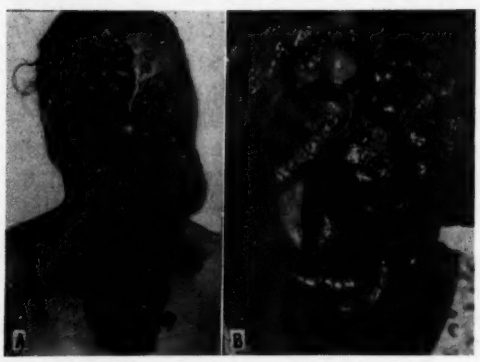

Fig. 5.—*A*, multiple tumors invading almost all of the patient's face. One of her eyes was lost and the mouth completely deformed. *B*, result of a surgical attempt to ameliorate the deformity.

Fig. 6.—Photograph showing tongue four times the normal size, owing to hemangiomas.

love." Though educated, she "narcotized herself" with her work, in order to "build a parenthesis of forgetting." During her periods of rest she had periods of anxiety followed by hyperexcitation or depression.

Undoubtedly, meloplasty could not bring about many changes in this psychic drama, which could be bettered only by a serene adaptation to life; nevertheless, the operation had to be carried out as a temporary therapeutic solution. The patient is satisfied with the results (Fig. 7*B*). But what will happen when, within six or seven years, the wrinkles reappear, dealing her psyche a still harder blow? Will the next surgeon be able to satisfy her narcissism, which today has been appeased?

I had to care for her psychologically during the postoperative period, thus protecting her against the future and freeing her of the complexes acquired through exaggeration of her physical defects.

The surgeon must "penetrate" the mental atmosphere of his patients. The human being rejects, whether openly or not, surgeons who offer only improvement of the physical defects; he wants more, a word of comprehension, a "greater interest" in his "misfortune," which is never merely physical.

It is at the very beginning that empathy appears, if at all. The first contact is definitive. At this moment the surgeon will either win or lose his patient. And let us not forget that patients are predisposed to this impact of mind upon mind; they expect it. The entire personality must be taken into account. Only thus can the surgeon deal with the patient in such a way as to show him that his suffering has been interpreted, understood and sympathized with by the doctor. It is in similar situations that positive contact and empathy have been achieved, producing a catharsis that greatly facilitates the taking of a thorough anamnesis.

A case of this order was as follows: A healthy man aged 54, born in a Latin-American country, very wealthy, married,

Fig. 7.—*A*, wrinkles on the forehead, at the external corners of the eyes, in the nasogenal furrow and on the neck. *B*, results of meloplasty, which improved the patient's appearance and restored her psychic balance.

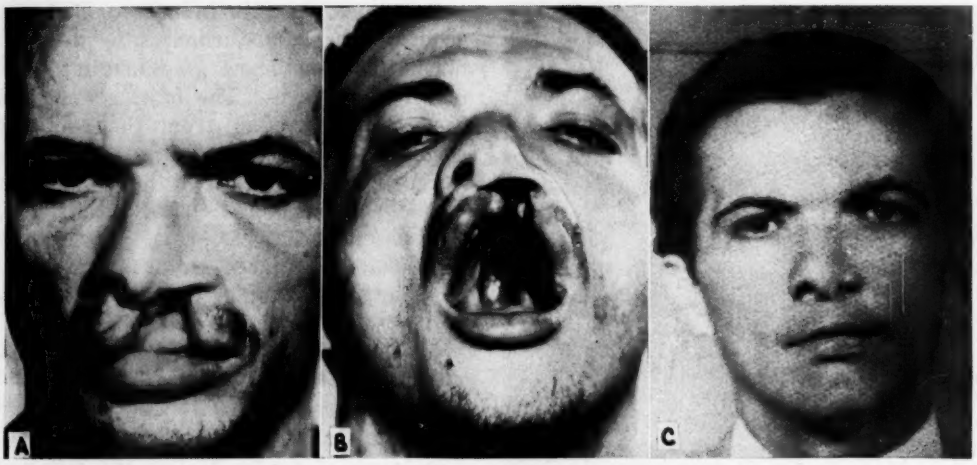

Fig. 8.—Unilateral complete harelip. Note the large palatal fissure with separation of the dental arch. *C*, postoperative appearance.

with 6 children, came to Buenos Aires for correction of prognathism and facial wrinkles. Introverted, with the psychosomatic temperament of the introvert, he explained his difficulties thus: "When I go to a restaurant, everyone rivets his eyes on my chin and cheeks; in business I have no success, since I feel depressed." He asked me imperatively to operate upon him, saying that he was ready to face any danger. He was stoical during the operation. I had the explanation some time later, through the confidences of one of his intimate friends. His complex was caused by his position in society since his second marriage, to a woman much younger than himself.

In such a case the surgeon knows quite well that the patient hides and disguises the true cause of his anxiety. Operation must be carried out after the patient has been informed of its importance and after he is told that it will fulfill his illusion of perfectibility.

Embarrassment due to deformity may be transferred. One good example is the case of a young man who came to me accompanied by his fiance and said: "I want my fiance's chin to be operated on. I do not like her the way it is."

The young man's attitude showed him to be sure of his mental influence on the girl, and she accepted his decision, convinced of the importance of her defect. In both, anxiety was lessened by the operation.

A eumorphic person with a defect, inherited or acquired, may change into a dysmorphic person if subjected to a logical psychic impact or a change of ambient influence. A teacher 22 years old "created" in her mind a strong inferiority complex by hearing one of her pupils make a joke about the size of her nose.

"Up to then," she said to me, after syntoncopsychy had been obtained in anamnesis, "I had never thought of my defect." From then on, however, the compulsive desire for improvement made her beg for plastic correction, which, once carried out, rebalanced her psyche.

A eumorph in his natural environment —a Negro in Africa, a Chinese in the East —may be a dysmorph among white men. This is the reason for the anxiety of certain persons to be transformed in appear-

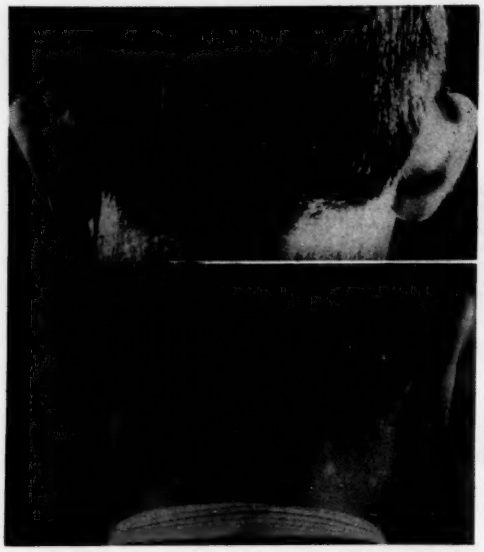

Fig. 9.—Wing-shaped ears corrected belatedly (preoperative and postoperative views).

ance — they feel that it will help them adapt themselves to their environment.

Semites have their noses and ears corrected to escape racial persecution. Even now the maladjusted ones ask for such correction, which they consider necessary for the elimination of racial stigmas.

If the defect is congenital and its bearer attributes it, for example, to maternal or paternal syphilis, he will accuse his parents and will create a psychic state of hostility to them. For example: A man 30 years old, on whom I operated in Uberaba, Brazil, was introduced to me by a Brazilian colleague who knew the intense physicopsychic drama that tormented the patient, who had a harelip and a palatial fissure (Fig. 8*A* and *B*). He lived far from his parents, to whom he attributed his deformity.

Operation brought about an improvement of his morphophysiologic state (Fig. 10*C*). Psychologic treatment during the postoperative period put him back in society, living more easily with his fellows.

Age, also, has its influence. Children acquire psychic disturbances by aeitonomasia. The least shock gives origin to premature complexes. The most common is the complex arising from the hoots of schoolmates referring to wing-shaped ears (Fig. 9). It is my opinion that this defect should be corrected before the child goes to school.

In many instances children are overcome by timidity on account of these complexes; they improve considerably, however, once their physical defects and mental imbalance are corrected.

The professional activities of the patient are also to be taken into account. A dancer asked me to modify the size and rear angle of her ears, which prevented her from combing her hair upward in order to take part in a certain ballet. It was a professional necessity that had to be considered by the plastic surgeon (Fig. 10).

This patient had no recollection of

Fig. 10.—*Above*, preoperative views of ears from the front and in profile. *Below*, similar views after surgical correction.

trauma in infancy or adolescence. The deformity had not given rise in her to defensive aggressive attitudes. There was no depreciation of personality. It was simply a professional necessity.

As an example of the importance of a physical defect in the normal development of an activity, I shall present the cases of 2 men, affected with rhinomegaly and platyrrhiny respectively (Fig. 11*A*). After obtaining the anamnesis, I was able to explain the complexes that prevented them from reaching full development in their respective activities.

One double operation was performed, involving the use of a homograft which, taken from the rhinomegalic patient, was applied to the platyrrhinic patient, and

Fig. 11.—*A*, preoperative view of patients face to face. *B*, postoperative view.

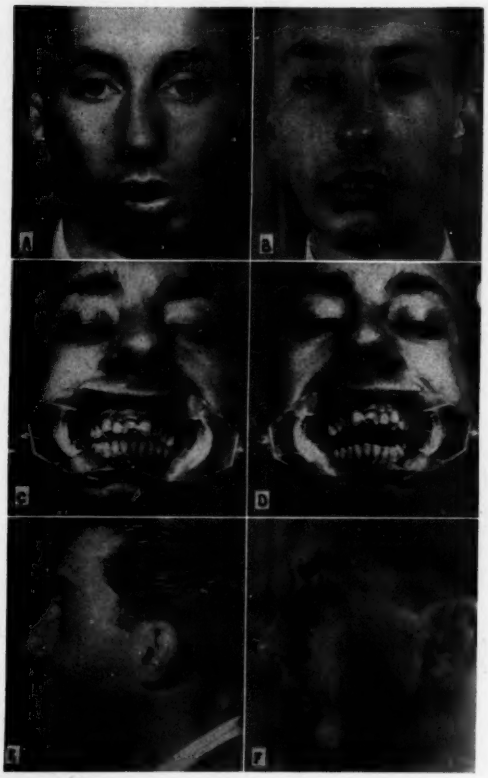

Fig. 12.—*A*, preoperative photograph showing micrognathism. *B*, postoperative view, showing cosmetic improvement. Will the patient's psychic difficulty be cured also? *C*, preoperative photograph showing bilateral temporomaxillary ankylosis. *D*, postoperative view; two pieces of vitallium inserted in both ascending branches of the interior maxilla modified the opening. *E* and *F*, postoperative photographs showing final result.

corrected both defects (Fig. 11*B*). Thus, by the same surgical act, the psychophysical of 2 patients was improved.

Facts cannot be considered separately; they must be taken as representing a total experience, in which the anatomic disharmony is considered in its relation to the psychic phenomena and the incidental and ambient factors.

Autognosis of the abnormality built up by the patients must be carefully eliminated by the doctor before he can arrive at a decision as to therapy, the value of

Fig. 13.—Mentothoracic bridle that hinder extension of the neck, thus marring the patient's physical appearance.

which is heightened by analysis of the total personality.

There are patients who insist that the surgeon solve urgent anatomopsychic problems, for which treatment must be applied without any consideration of the psychosomatic effects.

A case of this kind was that of a patient with temporomaxillary bilateral ankylosis and micrognathy (Fig. 12). The two defects prevented him from eating, speaking and walking freely among his fellow creatures. Depreciation of his personality through autognosis was not very strong, but he was unable to develop any activity.

The correction, in operative stages, of the ankylosis that interfered with his biting, enabled him to improve his chewing and his articulation in speech.

In this case the patient's awareness of the defect was maximum, though there was no sublimation or catathymy; there was, however, some introversion. The surgical operation offered the only solution from any point of view, and it was carried out the moment the defect had attained a point capable of giving rise to anxiety. The psychic state of the patient was improved in every way. His intellectual qualities were extremely helpful.

As a second example of the same type I should like to mention the case of a Brazilian girl 12 years of age, born in Uberlandia, who asked me to correct a mentothoracic chyloid bridle (Fig. 13). Sensitive and dynamic, she had overestimated her defect and acquired the mind of an introvert. In her subconscious there grew irritative thorns, which were eliminated during the anamnesis when she told me her dreams. She dreamt very often that she was beating her brother, who laughed at her, or that she was escaping persecution by her companions, who tried to take off the handkerchief covering her neck.

In the immediate as well as in the postoperative period I was able to verify, with the collaboration of Brazilian colleagues, the fact that the patient's dreams had improved greatly. She was less aggressive, and her "flights" were less violent. After a year her parents told me that her personality had changed and that her marks at school were much better.

SUMMARY

In the author's opinion, a comprehensive and detailed history plays an important part in the solution of problems presented by patients to doctors in general and to plastic surgeons in particular. Once an understanding has been reached, catharsis reveals to the researcher the mental problems caused by physical defects that lead the patient to such professional help.

Thus guided, the surgeon must proceed in accordance with his psychosurgical ex-

perience, not forgetting that patients are integral psychosomatic beings Thus treated, patients will get the total benefit of the treatment offered by the surgeon.

ZUSAMMENFASSUNG

Nach Ansicht des Verfassers spielt eine umfangreiche und ins Einzelne gehende Krankheitsgeschichte eine wichtige Rolle in der Lösung der Probleme, die der Kranke dem Arzt im allgemeinen und dem Chirurgen, der plastische Operationen auszuführen hat, im besonderen, vorlegt. Ist eine Verständigung zwischen Arzt und Patient erreicht. So kommt es zu einer seelischen Entspannüng des Kranken, der nünmehr dem Arzt auch seine seelischen Probleme eröffuen wird — Probleme, die eine Folge körperlicher Defekte sind, derstwagen arztliche Hilfe ursprünglich gesicht würde.

Es ist die Aufgabe des Chirurgen, von dieser Kenntnis geleitet und gestützt auf eine psychologisch-chirurgischen Erfahrungen, sein Handeln einzurichten, und nicht zu vergessen, dass der Kranke eine untrennbare psychosomatische Einheit ist. Bei solchem Vorgehen wird der Kranke den vollen Nutzen aus der Behandlung ziehen, die der Chirurg zu bieten hat.

RESUMEN

En la opinión del autor la historia detallada y comprensiva es importante en la solución de los problemas que presentan los pacientes al médico general y al cirujano plástico en particular. Una vez que se ha alcanzado cierto entendimiento, se revelan al investigador los problemas mentales producidos por defectos físicos, que obligan al paciente a buscar la ayuda profesional.

Guiado en esta forma, el cirujano debe actuar de acuerdo con su experiencia psíquicoquirúrgica, sin olvidar que los pacientes son seres psicosomáticos. Los pacientes tratados en esta forma recibirán el beneficio total del tratamiento ofrecido por el cirujano.

RÉSUMÉ

L'auteur est d'avis qu'une anamnèse détaillée joue un rôle important dans la solution des problèmes de chirurgie plastique. Celle-ci établira une telle confiance entre la patient et le médecin que la malade parlera avec beaucoup plus d'aisance de ses imperfections physiques.

Toutefois, le chirurgien ne devra jamais oublier que chaque malade ayant besoin d'une opération plastique est une entité phychosomatique.

RIASSUNTO

Secondo l'autore, un'anamnesi completa e dettagliata gioca un ruolo molto importante nella soluzione dei problemi presentati dai pazienti ai medici in genere e ai chirurghi plastici in particolare in quanto rivelano gli stati mentali causati dai difetti fisici che inducono pazienti a richiedere le prestazioni professionali. In psicologica e chirurgica, mai dimenticando che i pazienti rappresentano un tutto psico-somatico inscindibile. Soltanto cosí visti e curati, i pazienti possono ritrarre un completo vantaggio dall'opera del chirurgo.

The difference between a human being ten years of age and one fifty years of age lies altogether in the matter of toys.

—H. O'Malley

Artificial Hibernation

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THE following work, presenting the theory, rationale and technic of pharmacodynamic hibernation, is principally that of Prof. Henri Laborit of France.[1] On superficial appraisal, the entire concept is so foreign to the accepted conventional idea of disease and the organism's reaction to it that one's tendency is toward strong skepticism. More thorough study, however, reveals an extremely appealing concept, which may well be the solution to many basic medical problems previously taken as unexplainable. On the other hand, the plausibility of these theories may be misleading. Much of the clinical empiricism employed now is gradually being fortified by scientific investigation.

Artificial hibernation is characterized by a diminished reactive state of being in which noxious stimuli cannot provoke a stress response violent enough to be detrimental to the organism. This passive state of being is brought about by drugs and hypothermia. It is in direct contrast to the generally accepted therapeutic principle that one must bolster, fortify and increase the amplitude of organic reaction to disease and trauma.

This theory of hibernation centers about the neurovegetative and endocrine systems. Normally, through the mechanism of these systems, man is rendered homeostatic; that is, he is endowed with the capacity of maintaining a stable internal environment, or, as Claude Bernard labeled it, a stable "milieu internal." He is able to preserve the constancy of the chemical elements of his intracellular and intercellular fluids, the dynamics of his blood vascular system, and the regularity of his body temperature within a certain environmental range. This is in contrast to the poikilotherms, or cold-blooded animals, whose internal chemical values fluctuate with the temperature of the surroundings.

Cannon called the maintenance of this internal environment homeostasis, by virtue of which man is relatively independent of environmental variations.

However, man, unlike animals lower in the scale with a less complex neurovegetative system, is unable to adapt to his surroundings to any extent. He attempts only to maintain this homeostasis under whatever conditions prevail. This may not be favorable to the protection of his existence.

Selye's theory of the general adaptation syndrome, according to which disease and death are caused by the organism's attempt to maintain the *status quo*, is evidence that all physiologic reactions to stress or trauma are not necessarily beneficial. Selye maintained that with stress there comes first an alarm reaction (precipitated by the neuro-pituitary-adrenal axis) — then a phase of resistance (body reaction to maintain homeostasis) and finally the phase of exhaustion and death.

Laborit's hypothesis, which led to the use of hibernation as a seemingly paradoxical method of combating stress or the effects of trauma, parallels Selye's in some respects and issues from the observation that when the organism is subjected to a stimulus the regulating neuro-endocrine

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centers set in motion a train of reactions intended to maintain homeostasis. If the trauma is moderate, these reactions can master it. If the stimulus is severe or sustained, however, or the subject is debilitated, the defensive phenomena may persist intensively, exhausting the organism's last reserves of vital energy. This in turn will produce the humoral and autonomic imbalance (alterations in the blood vascular tree, reduction of circulating blood volume and the attendant symptoms) characteristic of shock. The neuroendocrine system defends life under varying circumstances within a certain range, but when extreme stress is encountered it may paradoxically be the instrument of exhaustion and death.

Hume recently corroborated certain aspects of this theory, citing the effect of trauma on the neuro-endocrine systems and the pathways it takes. All of the neural pathways seem to go first to the hypothalamus (Hess[3] stated that the hypothalamus is the regulator of all vegetative affectors), where the nervous energy is converted into a humoral substance that stimulates the anterior pituitary to put out ACTH in excessive amounts in the presence of moderate trauma. This acts on the adrenal cortex, provoking increased corticoid production. The corticoids, according to Sayer's work *The Adrenal Cortex and Homeostasis*[4] have a regulatory effect on every element of body metabolism — salt and potassium mobilization; water retention; glyconeogenesis, and fat and protein metabolism. Owing to continued stress, there may be an excessive call by the tissues or inability of the hormones to respond consistently. This may be the exhaustive phase.

Hume showed that, after electrodesiccation of the median eminences of the hypothalamus, trauma will no longer stimulate the pituitary to put out an excess of ACTH, and thus the adrenal corticoid output will not be influenced. If this can be done by physical or pharmacologic means without interfering with vital functions, the deleterious effects of trauma and stress may be obviated.

In an attempt to circumvent the terminal exhaustive phase and to diminish the unfavorable reaction to trauma, Laborit promulgated the idea of rendering the organism insensitive to the physiologic effects of stress by inhibiting the neuroendocrine system and reducing the body to a hypometabolic state. The theory is quite unorthodox; generally we attempt to augment the defense and respect the dogma of maintenance of normal blood pressure, temperature and pulse rate as a means of preserving this internal environment to protect the organism against trauma or disease.

The means by which a moderation of the reactions of the defensive mechanism is attained is a pharmacodynamic neuroplegia supplemented by refrigeration. The two have a somewhat similar action, but the neuroplegia must be initial or it would be impossible to cool the body without precipitating a severe defensive reaction. The normal reaction to cold (shivering, vasoconstriction, increase in metabolism) must first be abolished. The combined effect of the two is termed "artificial hibernation."

In recent years certain compounds of the phenothiazine group have been found to oppose the propagation of neuroendocrine transmission and to inhibit some of the chemical interagents (epinephrine and acetylcholine) liberated by it. The principal drug used in artificial hibernation is thorazine.*

Its exact mode and location of action are not entirely known. In 1951, Courvoisier[5] showed that Thorazine inhibited vagal stimulation and that some of its action was central. There was uncertainty as

*Thorazine, supplied by Smith, Kline & French Laboratories, was originally developed in France by Rhone-Poulene.

to its peripheral ganglionic blocking effect. Its central action has been deduced to be diencephalic, suppressing portions of the hypothalamus and preventing stimulation of the anterior pituitary.

The pharmacologic properties of thorazine have been thoroughly studied.[6] From its action on the neurovegetative system, Thorazine has a definite hypotensive action, which is most probably due to its vasodilating effect. In animals there is a weak antihistaminic and adrenolytic effect. Its hypothermic property is supposedly based on increasing peripheral vasodilatation and depression of the thermoregulatory center, which concomitantly prevents an increase of metabolism. It has a great augmentative effect on hypnotics, anesthetics, narcotics and other depressants of the central nervous system, as well as on muscle relaxants such as curare and curare-like drugs. However, it is a respiratory stimulant and the apnea-producing dose of curare, in its presence, must be great. It has a dilating and desiccating effect on the bronchi and the bronchioli. It reduces cerebral metabolism, decreasing oxygen consumption.[7]

Thorazine in the definitive sense of the word is not an anesthetic. Its action precipitates no loss of consciousness and no suppression of reflexes, yet feeling is suppressed and a semiconscious uninterested state prevails, which terminates in postoperative amnesia.

In the induction of artificial hibernation this drug is not used alone. There are two other elements in Laborit's neuroplegic blocking mixture—an antihistaminic (phenergan), which counters the organism's release of histamine, and demerol, an analgesic which is also a cortical inhibitive agent.

The hypothermic component of artificial hibernation facilitates lowering of the metabolic rate and reduces organic requirements and oxygen consumption. The extent of this metabolic reduction cannot be approached by neuroplegia alone and can be achieved only by refrigeration. Under hypothermia that reduces the metabolic rate 20 to 30 per cent, cardiac output is decreased. It has been ascertained experimentally by Callaghan and others[8] that monkeys cooled to 20 C. showed an intense depression of cortical activity, with unconsciousness and loss of motor power and reflexes, but no evidence of cerebral damage. Rewarming results in complete recovery with no permanent ill effect. Berne's[9] experiments demonstrated that the drop of arterial pressure in the presence of severe hypothermia is not a manifestation of myocardial failure but is due to reduction in cardiac output without circulatory failure. Bradycardia and a decreased stroke volume are present and account for the reduction of output, and cardiac failure does not supervene. No hypoxia of cardiac muscle occurs.

This combination of neuroplegia and refrigeration attempts to prevent extreme reactions of the neuro-endocrine systems as a defense mechanism. Hibernation intervenes to induce a semiconscious form of relaxation, with a physiologic indifference of the organism to stress, whether traumatic, toxic or psychologic. During this passive period the organism is given a chance to recover and live, for while this reprieve is maintained the erasure of the causative agent may simultaneously be actively pursued.

During artificial hibernation the volume of circulating blood must be maintained and the fluid and electrolyte balance assured. The caloric requirements are much reduced, and oxygen consumption is as much as 20 to 25 per cent below normal, giving a greater margin of safety.

Indications. — Generally speaking, artificial hibernation is indicated (1) for anesthesia and its concurrent protective

*Phenergan was supplied by Wyeth Laboratories.

action in the presence of surgical stress and (2) possibly as therapy for a severe illness.

The most obvious use is in anesthesia. It is known that the lower the metabolic rate the more sensitive is the subject to anesthetic agents, and also that a state in which the cellular oxygen requirements are markedly deduced is extremely favorable to the patient. When this method is used in anesthesia, the drug may be used alone in premedication because of its amnesic and sedative effect, or as potentializer of anesthesia. In the latter use, anesthesia of undesirable depth and prolonged periods of respiratory arrest due to curare are avoided. Potentiated anesthesia is the use of these innocuous drugs (with few or no anesthetic properties) in conjunction with weak anesthetics to produce effective general anesthesia. Or the method may be used alone, with employment of both the drug and refrigeration. The indication for this is usually the fact that the patient is elderly or a "poor risk" or in need of an ultramajor operation. However, it may come to be the method of choice in such specialties as thoracic surgery and neurosurgery. [16, 20].

Technic.—On the evening before operation, phenergan (100 mg.) and nembutal (½ gr.) are given orally. This affords the patient a calm night. Three hours prior to the operation phenergan (50 mg.) and demerol (100 mg.) are given intramuscularly. A mixture of 50 mg. of thorazine, 50 mg. of phenergan and 100 mg. of demerol (equaling 6 cc.) in 100 cubic centimeters of dextrose or saline solution is then allowed to drip intravenously for one hour. Semiconsciousness will usually supervene, and though this is a good sign of the patient's readiness it is not necessarily a criteria of neurovegetative stabilization. The blood pressure in millimeters of mercury should drop to 80 or 90 systolic, with a proportionate drop in diastolic pressure. The respiratory rate drops to 8 to 12 per minute, with increased amplitude, and the pulse rate remains around 80 after an initial rise. The skin stays pink.

Refrigeration may be started as soon as the semiconscious state is attained. Usually 6 to 8 ice bags are placed in the axillae, the inguinal regions, the chest and the abdomen to bring the temperature down to 93 to 96 F. More refined methods, such as refrigerating blankets and iced sheets, may be used but are unnecessary unless greater depths of hypothermia are required. If the vegetative block is incomplete there will be a rise in blood pressure and the patient will shiver (this is to be strenuously avoided, because of the metabolic rise). In these circumstances the mixture may be speeded and a few ice bags removed temporarily.

When the blood pressure can be maintained at about 90 systolic and 60 diastolic and the pulse rate and respiratory rate are respectively at 80 and 8 to 12 for twenty to thirty minutes, the patient is ready. The temperature at this time may be 93 to 96 F. and descends even lower. Intubation may be done with no adjuvants, or half the normal dosage of curare may be necessary. A maintenance infusion is continued during the procedure at a slow rate, consisting of 50 mg. of thorazine, 50 mg. of phenergan and 100 mg. of demerol in 1,000 cubic centimeters of dextrose in distilled water. In some cases it may be necessary to supplement this with a small amount of 50 per cent nitrous oxide. Usually only oxygen is administered during the operation. Postural changes (Trendelenburg) will raise the blood pressure. Usually, with poor surgical risks even under serious surgical stress, the pulse, blood pressure and respiration remain constant. There is usually a reduction of bleeding under hibernation. The patient is returned to his room in a flat

position, which is maintained for twenty-four hours.

Postoperatively the intravenous perfusion is continued at a maximum of 1500 cc. per day, with maintenance of electrolytic balance. For every twenty-four-hour period a mixture of 50 mg. of thorazine, 50 mg. of phenergan and 100 mg. of demerol is introduced intravenously. The patient is covered only by a sheet in a room at 65 to 70 F., or ice bags may still be used. Pulse, blood pressure, respiration and temperature are recorded hourly. The course of these recordings will dictate the speed of the stabilizing mixture and the room temperature to be maintained. The patient is amnesic and analgesic—no other medication is needed even after an extremely painful procedure. The mixture lowers the coagulability of the blood. Antibiotics and vitamins are used as indicated. Secretions are usually reduced, and pulmonary complications are unusual. Excretion of urine is adequate, but retention is the rule, and an indwelling catheter is used. Vomiting is rare as the drugs are antiemetic, but in cases of gastric and intestinal conditions Wangensteen suction is maintained. The abdomen is usually flat, with no bowel sounds until dehibernated. Pain to palpation is a sign of complications.

When the patient is ready, which may be at any time from eight hours to three days after the operation, the mixture is stopped, the patient is gradually warmed with blankets and dehibernation is attained. All values may "overshoot" on dehibernation.

Complications. — The complications are few. Usually debilitated and sickly patients are easily blocked. But some patients are extremely resistant. An occasional patient may have a severe drop in blood pressure, which may be treated by positioning and slowing the administration of the mixture.

At temperature of about 30 C. (86 F.) it has been observed that cardiac irregularities are nonexistent, but Dundee[10] has claimed that at temperatures lower than 28 C. cardiac irregularities are dangerous, particularly if cardiac manipulation is required.

There is a prolongation of the bleeding and clotting time, which must be taken into consideration.

Supplementary Data. — In recent months a large bibliography has been accumulating on this subject, primarily from Europe. Dundee[11], by animal experimentation, compared the mixture as used here, the individual constituents, deep anesthesia and muscle relaxants as a means of hypothermia, and found that Thorazine alone was by far the most effective. He also showed the decrease in oxygen intake (as did Bigelow[12]) with the fall in temperature concomitantly with the fall in respiration and pulse. When respirations were aided, there was no cardiac arrest at temperature of 21 to 22 C.; without aid, however, it occurred in 3 dogs at 23 to 26 C. On the other hand, Irmer and Koss[13] showed the drugs to have beneficial effect on cardiac reflexes in cases of intracardiac operations on man.

Dundee also demonstrated bronchospirometrically in 12 cases of artificial hibernation, that a drop of 8 to 10 per cent in oxygen consumption occurs after administration of the drugs alone and another 10 to 15 per cent after refrigeration. It has been observed that with open chest operations the drop in temperature is 2 or 3 degrees below the average. Peruzzo[7] showed that thorazine alone decreases oxygen consumption by tissues *in vitro* and *in vivo*, and for nervous tissues it decreases it independent of any fall in temperature. It is comparable to refrigeration at 86 F. These observations are of interest in the protection of nervous tissue, which is so sensitive to anoxia

during cardiac operations. Also, it has been shown that there is a great increase in oxygen consumption under deep anesthesia, in contrast to the decrease in oxygen consumption under hibernation. Without refrigeration, the metabolic rate drops 14.3 per cent and 2.2 degrees Fahrenheit.[14]

Drovante and Peruzzo,[15] by creatinine clearance and the para-aminohippuric acid tests in hibernated dogs, revealed a functional decrease in glomerular filtration and an increase in tubular reabsorption, but no organic changes in the kidney.

Outside the field of general surgery, artificial hibernation is especially suited to thoracic procedures. Irmer and Koss[13] consider it particularly important in increased safety against respiratory and circulatory hypoxia. It insures good respiratory activity without central respiratory paralysis, effective postoperative analgesia and desiccation of the bronchial apparatus, and it prevents laryngeal and bronchial spasm.

Steinbereithner[16] revealed the efficacy of hibernation in neurosurgical procedures, especially lengthy ones. He stated that for operations near the diencephalon it is especially indicated, because it allows a lowered oxygen concentration in the blood stream without nerve damage due to hypoxia. He reported 45 neurosurgical operations, saying that respiratory disturbances were rare and hyperthermia was avoided. Cerebral vomiting and singultus were nonexistent, as were states of excitement and motor unrest.

It can readily be seen that concomitantly, in the use of artificial hibernation as an innocuous, form of anesthesia, the patient is given additional protection against reactions to the stress of a surgical procedure, with the advantage of obviating any possibility of hypoxia.

Therapeutic Possibilities. — This technic may also be used as a therapeutic procedure in states of overwhelming stress. In the study of methods of inducing hibernation, some of Laborit's first experiments were on hemorrhagic shock.[17] He demonstrated, using Wigger's technic, that animals maintained at an arterial pressure of 40 millimeters of mercury under hibernation will tolerate this state of shock for a longer period, without irreversibility or with less blood replacement.

This work was further extended clinically in 1952 and 1953, during the Indo-China War, by military surgeons,[19] who used artificial hibernation for the prevention and treatment of traumatic shock. Three hundred cases were reported by the consulting surgeon of the French armed forces. It was difficult to prove that the conventional method of therapy for shock would not have been satisfactory for most of these patients; however, in 10 per cent of "desperate cases" in which transfusion failed, artificial hibernation was effective. Other therapeutic possibilities reported are the treatment of hyperthermic children[20] and coronary artery disease.[21]

Our experience at the Sinai Hospital in Baltimore comprises 18 surgical cases and 6 cases of clinical experimentation under artificial hibernation. Our results have been extremely gratifying and have provoked much stimulating controversy concerning tangential problems which should be investigated.

The patients subjected to hibernation were chosen as the poorest of surgical risks for major procedures (see table). There were 3 deaths; 1 patient (Case 15) aged 79 with a giant fibroid, died of cardiac arrest immediately after the operation. At postmortem examination, unsuspected acute pericarditis was discovered. It was impossible to dehibernate 1 patient (Case 3) aged 93. He died two days after the operation. The youngest patient, a quadriplegic aged 3 months (Case 11), was expected to die postoperatively,

Artificial Hibernation in Eighteen Cases

Case No.	*Reason for Hibernation*	*Patient's Age*	*Operative Procedure*	*Minimum Temperature F.*	*Comment (All Cases Intubated)*
1	Diabetes; hypertension; gangrene of leg; patient toxic	70	Midthigh amputation	95.4	No anesthesia
2	Peritonitis, incipient shock	44	Closure perforation, duodenal ulcer	97	Potentiated anesthesia (50% N_2O)
3	Hypertension, fibrillation, uremia	93	Suprapubic prostatectomy	87	No anesthesia—patient died 3 days post-operatively, could not be completely dehibernated
4	Carcinoma of cervix (Exenteration planned)	52	Pelvic laparotomy	95	Potentiated anesthesia (50% N_2O); inoperable
5	Severe coronary disease; recent pulmonary edema	67	Large sliding inguinal hernia	97	No anesthesia
6	Toxic, bilateral gangrene of legs; severe coronary disease, renal damage	73	Midthigh amputation	94	Potentiated anesthesia (50% N_2O); emergency preparation
7	Massive hemorrhage; jaundice; carcinoma of pancreas; patient comatose	51	Exploratory laparotomy, gastrotomy	95.5	No anesthesia
8	Hypertension; hemiplegia; mitral stenosis; cardiac failure; common duct obstruction	66	Common duct exploration (emergency)	95	No anesthesia
9	Chronic constrictive pericarditis	45	Pericardiectomy	95	Potentiated anesthesia
10	Recurrent carcinoma of larynx; auricular fibrillation	52	Gastrotomy	94.8	Potentiated anesthesia; patient resistant
11	Cord injury at birth; hyperthermia, (106° F.); quadriplegia	3 mo.	Spinal exploration, laminectomy	83	No anesthesia; Patient died by aspiration 3d day P.O., after dehibernation
12	Hypertension; severe coronary disease; carcinoma of colon	75	Exploratory laparotomy (inoperable)	94	No anesthesia
13	Rheumatic heart disease; mitral stenosis and insufficiency; cholecystitis	51	Cholecystectomy	94.6	Potentiated anesthesia (50% N_2O)
14	Diabetes; recent acute coronary disease; gangrene of leg	80	Midthigh amputation	93	No anesthesia
15	Hypertension; cardiovascular disease; fibrillation; huge abdominal mass	79	Hysterectomy (giant fibroid)	93	Potentiated anesthesia; cardiac arrest; Patient died; unsuspected acute pericarditis
16	Gangrene of extremity; coronary insufficiency	80	Midthigh amputation	94	No anesthesia
17	Auricular fibrillation; cardiac failure; jaundice; uremia; acute cholecystitis	63	Cholecystectomy	94	No anesthesia
18	Hypertension; coronary insufficiency; duodenal ulcer	45	Gastric resection	96	Potentiated anesthesia (50% N_2O)

but died prematurely from aspiration three days after the operation, after complete dehibernation had been attained. Most of these patients had severe and hazardous cardiovascular conditions—recent coronary occlusion, hemiplegia, dia-

betes, and hypertension. There were 18 operative patients, 10 of whom required absolutely no supplementary anesthesia. Most of the remainder were carried on small doses of 50 per cent nitrous oxide. Most patients were readily intubated after small doses of (3 to 4 mg.) tubocurarine.

The technic was essentially that described by Laborit, with use of the blocking mixture and ice bags. All patients went into hibernation easily. Three, however, were extremely difficult to keep down. The lowest temperature attained was 84 F. During operation the patients were quiet and relaxed; still one could talk to a semicomatose patient, and the peripheral reflexes were still present. The usual blood pressure was 90 systolic and 60 diastolic, the usual pulse rate 80 and the usual respiration rate 8 to 12. The longest procedure took three hours. The patients were "kept under" from six hours to three and one-half days. One patient was in severe shock from intra-abdominal bleeding (the blood pressure could not be maintained by transfusion until hibernation was achieved). In all cases, electrocardiograms taken during and after hibernation showed no change from the prehibernation tracings. Preoperatively and postoperatively all patients were kept in an oxygen tent or in a room at 68 F. for the cooling effect. Most patients were extremely quiet, with good color and dry skin, and almost euphoric. Rarely did a patient complain of pain, and narcotics were seldon given. Dehibernation was difficult in only 1 case (that of the 93-year-old man who died). All of the operative patients were amnesic and had only vague recollections of the hibernation. There was a general feeling of well-being on rewarming. Bowel sounds and defecation occurred one day after dehibernation. After the patient had been cooled, nursing care was no more complicated than that required by the average postsurgical case of a similar kind. The patient was turned every hour, at which time the pulse rate, temperature, respiratory rate and blood pressure were recorded. All patients were fed intravenously.

Special studies were done of some nonoperative patients both before and during hibernation. These data will be reported later.

CONCLUSIONS

The results of the author's experience, a brief one, corroborate those of the European investigators, and in his opinion artificial hibernation has exceptional merit. Whether its theoretical basis is valid will be determined only in the laboratory. This procedure at present should certainly not be used in a routine manner, nor is its use necessary with good modern anesthesia available. Its greatest advantage at present is for "poor risk" patients who must undergo the stress of surgical intervention, and it also allows a greater margin of safety in those procedures which may be associated with hypoxia than do the conventional forms of anesthesia.

RESUMEN

Los resultados de la experiencia del autor están en relación con los de los autores Europeos, considerando que la invernación artificial tiene un mérito excepcional. El laboratorio decidirá si la base teórica és válida. Indudablemento que este procedimiento no debe usarse actualmente en forma rutinaria, tampoco resulta necesario cuando se dispone de una buena anestesia. Su gran ventaja es para los pacientes considerados como malos riesgos que tienen que ser sometidos al "stress' de la intervención quirúrgica; tambien da un gran margen de seguridad en aquellos procedimientos que pueden encontrarse asociados con hipoxia en las formas convencionales de anestesia.

RESUMEN

Les resultats de l'experience assez limiteé de l'auteur confirment ceux des investigateurs Européens, et a son opinion l'hibernation artificielle est d'une valeur extraordinaire.—C'est dans le laboratoire seulement qu'on décidera, si la base théoretique est justifiée ou pas. Sans doute la méthode ne doit être employée ni généralement, ni si une bonne et moderne methode d'anesthésie peut être employée. Pour le moment on trouvera sa plus grande valeur dans les cas, ou un malade affaibli doit subir le risque d'une, intervention chirurgicale. Aussi elle donne plus de surete que les autres formes d'anesthesie dans les procedures qui pourraient être suivies de l'hypoxie.

RIASSUNTO

L'esperienza dell'autore sull'ibernazione artificiale non é vasta, tuttavia i suoi risultati concordano con quelli ottenuti dagli studiosi europei e nella sua opinione il metodo ha degli eccezionali vantaggi. Solo il laboratorio potrá dire es le basi teoriche del metodo siano valide; al momento presente non deve essere usato in tutti i casi e sopratutto quando vi sia a disposizione una buona anestesia moderna. L'impiego principale é rappresentato dai malati in cattive condizioni che debbano essere sottoposti ad un intervento chirurgico e in tutti quei casi in cui sia prevedibile una condizione di ipossia.

ZUSAMMENFASSUNG

Die noch jungen Erfahrungen des Verfassers bestätigen die der europäischen Untersucher. Der Verfasser glaubt, dass der künstliche Winterschlaf ausserordentliche Vorzüge bietet. Ob die theoretischen Grundlagen ihre Gültigkeit behalten werden, werden Laboratoriumsuntersuchungen entscheiden. Sicherlich sollte das Verfahren heutzutage nicht routinemässig zur Anwendung gelangen, und, wo gute moderne Betäubungsmethoden zur Verfügung stehen, erübrigt es sich. Der grösste Vorzug der Methode liegt zur Zeit in ihrer Anwendbarkeit an Kranken, die ein schlechtes Operationsrisiko bieten und sich doch den Anstrengungen eines chirurgischen Eingriffs unterziehen müssen. Ausserdem bietet das Verfahren eine grössere Sicherheitsbreite als die üblichen Formen der Narkose bei Eingriffen die zu Sauerstoffmangel führen können.

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Of voluntary euthanasia as another form of biological control I have had my say upon the two occasions when a Bill has been introduced into the Upper House, expressing grave doubts. Bizarre, the advocacy of this practice must surely appear to the doctor, since its operation would put his function into reverse. But I have thought it a question for the public, and not the doctor, to decide, although, if the citizen wanted to terminate his life, it would naturally fall to the doctor to carry it out. Speaking as a member of the public, however, it seems to me to be fraught with great objections.

The disease which is thought to be incurable today is curable tomorrow, and tomorrow would, of course, be too late to take another view. The relief of pain is the duty of the doctor and, with the many remedies and devices now available to him, should never be impracticable. Then there would often be a danger that the sick man may be unduly influenced by the impatience of his friends in face of his taking 'an unconscionable time in dying.' It was such a friend who once said to me: "Doctor, this agony cannot go on." "*Whose* agony?" I replied, for the patient, though dying, was free from agony . . . No, it would not do. There is a better alternative, and that is the meaning implicit in the sick man's mind when, holding his doctor's hand, he says, "You will stand by me, Doctor, won't you?"

—*Lord Horder*

Annular Pancreas

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ANNULAR pancreas is a rare congenital anomaly that occurs usually in the second portion of the duodenum, producing constriction of this organ and causing, clinically, partial duodenal obstruction. Owing to this constriction, dilation and hypertrophy of the proximal portion of the duodenum and frequently of the stomach are the results.

Embryolic Picture.—It is a well-known fact that the development of the pancreas is irregular, and this is evidenced by the frequent observation of ectopic islands of pancreatic tissue in other nearby organs, especially the duodenal and gastric walls.

The embryonic aspects of the pancreas have been discussed thoroughly by MacNaught, Howard and Cunningham. The organ arises from two entodermal outgrowths, the dorsal and ventral anlages. The dorsal anlage extends out from the anterior wall of the intestinal tube just proximal to the common bile duct. Practically all of the pancreas is formed from this portion except the head, which arises from the ventral anlage. This latter is divided into two buds, right and left. The left normally becomes atrophied. As the intestine develops and rotates, it carries the ventral anlage, and this ultimately fuses with the dorsal anlage. The duct system of these two sections also unites. The former provides part of the head, while the latter provides the ducts of the body, the tail and part of the head.

Any failure of atrophy of the left bud of the ventral anlage may cause a serious developmental irregularity.

Bovill and Baily, in July 1952, wrote an enlightening paper on annular pancreas, in which they described the embryonic and normal anatomic nature of this condition, stating that the annular ring of the pancreatic tissue represents persistence of the left half of the ventral anlage, the tip of which remains fixed to the duodenal wall in an anterior position and becomes stretched around the right side of the duodenum upon migration of the remaining portion of the ventral pancreas.

Anatomohistologic Data.—The pancreatic tissue from the annular pancreas cannot be differentiated from that of normal pancreas. It possesses islets of Langerhans and acinar glands, as well as a system of ducts that enter into the main pancreatic duct of Wirsung (Fig. 2). First, it occurs as a complete thick ring engulfing all of the duodenum; second, sometimes the ring is not entirely complete on the anterior aspect and therefore is less constricting than is the complete encirclement, and third, it may show up as aberrant pancreatic tissue in the walls of the stomach, the duodenum and the surrounding organs. The first and second produce constriction of the second portion of the duodenum, with symptoms of duodenal obstruction and at times with dilatation of the stomach.

Sometimes the pancreatic tissue is so adherent to the walls of the duodenum that it is impossible to separate the two structures surgically.

Age.—Annular pancreas may occur at any time from birth to old age; 1 case has been reported in which the patient was 74

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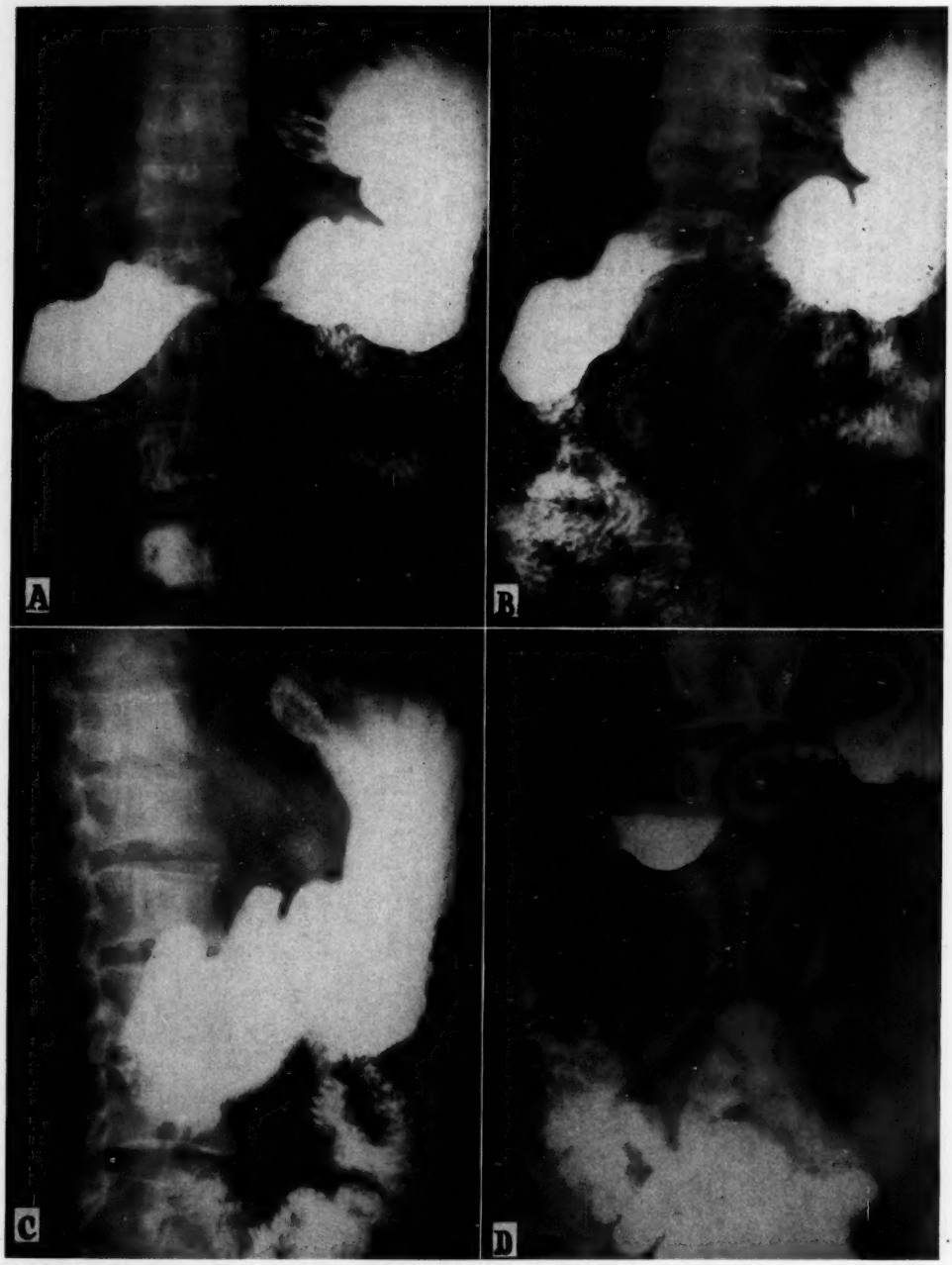

Fig. 1.—*A*, Roentgenogram demonstrating markedly widened proximal duodenal loop with duodenal thinning distal to obstructive pancreatic band. *B*, Another roentgen phase showing dilatation. *C*, Oblique view, showing same partial obstructive phenomenon. *D*, Six hour progress film, showing some gastric and duodenal retention.

TABLE 3.—*Annular Pancreas (Bovill and Bailey)*

Ref. No.	*Reported By*	*Sex Age*	*Operation*	*Result*	*Remarks*
11	Glover and Barry, 1949, case seven	Female 5 wks.	Partial resection or division of the ring.	Recovery, but continued Vomiting.	Re-exploration in 4 days, gastrojejunostomy gave relief.
12	Goldyne & Carlson, 1946	Male 26 yrs.	Same	Symptomatic cure.	Post-op., X-ray: persistent gastric and duodenal residue.
14	Haden, 1950	Male 3½ yrs.	Same	Recovery, but occasional complaint of abdominal pain.	Post-op., X-ray: Slight dilatation of first portion and partial persistence of the defect in the second portion of duodenum.
15	Howard, 1930	Female 46 yrs.	Same	Recovery, pseudo-cyst developed.	Incision and drainage of pseudo-cyst.
17	Lehman, 1942	Male 23 yrs.	Same	Recovery, but persistent symptoms of obstruction.	Post-op., X-ray: Persistent deformity of the duodenum.
18	Lerat, 1908	Female 46 yrs.	Same	Recovery	Pancreatic fistula closed spontaneously.
24	Payne, 1951	Male 32 yrs.	Same	Recovery, but developed ulcer symptoms.	Post-op., X-ray: Dilated second portion of duodenum with retention.
25	Ravitch and Woods, 1951, first case	Male 67 yrs.	Same	Recovery, but symptoms recurred.	Re-exploration revealed scar tissue over excised ring area causing abstruction. Ant. Duodenojejunostomy for relief.
7	Conroy and Woelfel, 1951, first case	Male 30 yrs.	Partial resection of the ring plus exploratory duodenotomy of the first portion.	Cured	Redundant portion of duodenum was resected.
4	Brown, Bingham, Cronk, 1948	Female 53 yrs.	Same	Died	Sub-diaphragmatic abscess, duodenal fistula. Post. gastroenterostomy on the 22nd post-op. day.
30	Zeck, 1931	Female 31 yrs.	Partial resection of the ring plus Heincke-Mikulicz plastic enlargement of constricted duodenum.	Recovery	Small pancreatic fistula healed spontaneously.
5	Burger and Aldrich, 1949	Female 4 days	Same	Died, 9th post-op. day.	Developed bile-stained wound drainage.

29	Vidal, 1905	Male 3 days	Gastroenterostomy	Cured	Associated congenital atresia of duodenum.
28	Truelson, 1940, second case	Male 35 yrs.	Same	Cured	Included duodenotomy.
7	Conroy and Woelfel, 1951, second case	Female 26 yrs.	Same	Cured	Developed intestinal sprue.
3	Brines, 1931	Male 44 yrs.	Same	Died, 16th post-op. day of respiratory infection.	Annular pancreas first recognized at autopsy.
10	Dos Santos, 1906	Female 26 yrs.	Same	Died, 9th post-op. day of respiratory infection.	Same
26	Smetana, 1928	Male 74 yrs.	Same	Died, immediately post-op.	Same
2	Brines, 1930	Male 35 yrs.	Exploratory laparotomy and drainage.	Died, immediately post-op.	Annular pancreas first recognized at autopsy. Marked hemoperitoneum and pancreatitis.
19	Llorca and Barrios, 1950	Male 19 yrs.	Peon-Bilroth I gastric resection.	Recovered	Post-op., X-ray: Persistent narrowing of the duodenum.
25	Ravitch and Woods, 1951, third case	Male 6 days	Gastroduodenotomy	Cured	Marked congenital deformaties of viscera and mesenteries
13	Gross and Chisholm, 1944	Female 3 days	Duodenojejunostomy	Cured	Incomplete rotation of colon.
25	Ratvitch and Woods, 1951, second case	Female 3 days	Same	Cured	None
11	Glover and Barry, 1949	Female premature 2½ lbs.	Same plus division of ring.	Died, 4th post-up. day.	Stenosis of duodenum.
9	Custer and Waugh, 1944	Male 74 yrs.	Sub-total gastric resection with gastrojejunostomy.	Cured	Associated benign gastric ulcer.
1	Baker and Wilhelm, 1950	Male 59 yrs.	Same	Cured	Associated benign gastric ulcer.
23	Ohlmacher and Marshall, 1950	Male 27 yrs.	Same	Cured	Huge dilation of the duodenum, pylorus and stomach.
20	Markovitz and Dionisi, 1950	Male 41 yrs.	Same (partial resection of ring.)	Cured	Associated perforating duodenal ulcer.
	Baily and Bovill, 1951	Male 26 yrs.	Same	Cured	Annular pancreas encircled both first and second portions of the duodenum.

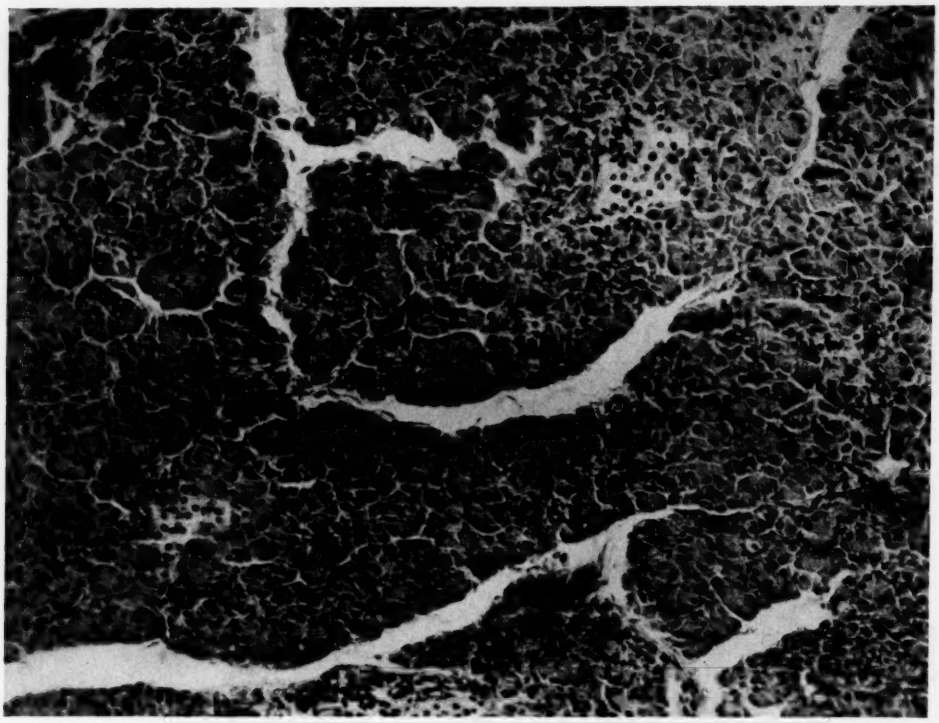

Fig. 2.—Microscopic section, × 100, showing normal pancreatic tissue.

Fig. 3.—*A*, Artist's conception of annular pancreas before operation. *B*, Artist's conception of same condition after operation.

TABLE 1.—*Age Distribution of Patients With Annular Pancreas*

Age	Number of Cases
Fetus	3
0 to 10 days	7
10 days to 1 year	5
1 to 9 years	3
10 to 19 years	2
20 to 29 years	9
30 to 39 years	10
40 to 49 years	3
50 to 59 years	4
60 to 69 years	7
70 to 79 years	5
Total	58

TABLE 2.—*Associated Anomalies with Annular Pancreas*

Malrotation of the intestines	3
Duodenal atresia	2
Duodenal stenosis	1
Hypertrophic pyloric stenosis	1
Partial absence of pylorus	1
Aberrant pancreas	2
Imperforate anus	2
Meckel's diverticulum	2
Mental retardation	2
Portal vein anterior to duodenum	1
Diaphragmatic hernia	1
Horseshoe kidney	1
Aplasia of kidney and ureter	1
Clubfoot	1
Cleft palate	1

years old (Table 1). It is more common in the male than in the female, in the proportion of 2½ to 1.

More than 70 cases have been reported in the literature, of which the condition in more than half has been discovered at the autopsy table. Annular pancreas is not the only anomaly observed in these patients. It is associated with other anomalies (Table 2).

Symptoms.—The symptoms of annular pancreas may resemble those of acute or chronic gastric, duodenal ulcer or partial duodenal obstruction; sometimes, if the ring is around the ampulla of Vater, it may produce jaundice, with or without the symptoms of duodenal obstruction. It is impossible to diagnose annular pancreas from the symptoms alone.

Diagnosis. — The diagnosis should be made from roentgen examination of the gastrointestinal tract. Any roentgenogram that shows dilatation of the first and second portion of the duodenum is more or less suggestive of annular pancreas. Conditions involved in differential diagnoses are diverticulitis of the duodenum, obstructive ulcer of the second portion of the duodenum, old adhesive bands, superior mesenteric ileus, pressure from extrinsic nodes, a greatly dilated common duct and enlargement of the head of the pancreas. The index of suspicion of annular pancreas is raised, however, when the duodenum is narrowed distal to the dilatation (Figure 1, *A, B, C* and *D*).

Treatment.— The treatment for relief of symptoms is divided into (a) resection of the pancreatic ring; (b) gastroenterostomy; (c) duodenojejunostomy, and (d) subtotal gastric resection. Resection of the ring has been abandoned by some surgeons because pancreatic or duodenal fistula has followed this operation. (Table 3).

The treatment most favored has been gastroenterostomy, although this method initially had its failures due to postoperative complications in the absence of antibiotics (Table 3).

REPORT OF CASE

A 32-year-old white man was admitted to the hospital on Jan. 31, 1954, and operation was performed on February 4. The patient claimed that he had never been ill except for occasional hyperacidity.

Two months prior to admission to the hospital he had lost a night's sleep, and on the following day felt a dull spasmodic pain in the right upper abdominal quadrant and the umbilical region. This lasted for a day or two and then disappeared. The pains recurred intermittently for about thirty days. About a month later, after he had eaten his lunch, he was seized by a sudden severe abdominal pain and had to stop working. His physician had a gastrointestinal roentgen series taken

and afterward advised an operation.

The patient, an automobile body laborer, had no bad habits, smoked moderately and had not lost any time at work.

Physical examination gave essentially negative results. The patient was well nourished. The eyes, ears, nose and throat were normal; there was no adenopathy in the neck. There was no rigidity. The thyroid was normal. The lungs were normal throughout, with no rales and no dulness. The heart was regular in rate and rhythm, with no murmurs. The blood pressure in millimeters of mercury was 103 systolic and 65 diastolic. The respiratory rate was 18 and the pulse rate 76. There was tenderness in the right upper abdominal quadrant and around the umbilicus, with some distention, but no fluid, no palpable masses and no rigidity of the rectus muscles could be detected.

A roentgen series of the upper part of the gastrointestinal tract revealed dilatation and redundancy of the first portion of the duodenum, but no other abnormalities. The results of blood chemical studies, including a Wasserman test, were normal. The preoperative diagnosis was partial obstruction of the duodenum due to an annular pancreas. The postoperative diagnosis was the same.

Operation.—This consisted of excision of a ring of pancreas and freeing of the duodenum.

With the region under spinal anesthesia, a paramedian incision was made and the abdomen explored.

A ring 1½ inches (3.7 cm.) wide surrounded the second portion of the duodenum, just below the first (Fig. 3*A*). It consisted of solid pancreatic tissue, producing constriction of this portion of the duodenum and therefore causing partial obstruction and dilatation above the obstruction. The pylorus was large and admitted two fingers; the spleen was normal; the kidneys were normal; the stomach, except for some dilatation, was normal; the rectosigmoid and the rest of the colon were normal. The pancreas was normal except for the ring previously described.

A Kocher maneuver dislocated the duodenum above the ring. The ring was exposed and dissected from the anterior wall of the duodenum and was transected on the outer margin. Then the pancreatic ring was dissected away from the wall of the duodenum to the mesial side of the ring where it joined the pancreas. This freed the anterior wall of the duodenum, causing this section to bulge. The mesial section of the stump of the ring consisted of a piece 1 cm. long, and this was sutured to the capsule of the pancreas, which prevented this section from coming into contact with the duodenum (Fig. 3*B*).

The patient's immediate postoperative condition was good. He made an uneventful recovery and was discharged from the hospital on February 12 with the incision well healed. The most recent follow-up, on December 5, proved that the patient had been relieved of all his preoperative symptoms.

Pathologic Report. — The specimen consisted of a piece of pancreas (Fig. 2). Macroscopic examination revealed segment of tissue 5 by 4 by 3 cm., resembling pancreatic tissue. Microscopic examination revealed normal pancreatic tissue. The diagnosis was annular pancreas.

This case is similar to the case reported by E. P. Lehman in April 1942.

SUMMARY

A case of annular pancreas is reported in which partial resection of the ring was done. There was no morbidity. The roentgenograms were rather typical. Differential diagnosis is considered and different operative procedures briefly discussed.

SUMARIO

1. É apresentado um caso de pâncreas anular, em que foi feita a ressecção parcial do anel sem morbidade.
2. São ràpidamente discutidos os diferentes processos cirúrgicos.
3. Os dados radiológicos eram típicos e o diagnóstico diferencial é considerado.

ZUSAMMENFASSUNG

1. Es wird über den Fall eines ringförmigen Pankreas berichtet, bei dem eine teilweise Resektion des Ringes ohne Krankheitsfolgen ausgeführt wurde.
2. Verschiedene Operationsvorgänge werden kurz erörtert.
3. Di Röntgenaufnahmen waren ziemlich typisch. Die differentialdiagnostischen Möglichkeiten werden in Erwägung gezogen.

RÉSUMÉ

1. Un cas de pancreas annulaire est reporté en quel la résection de L'anneau etait fait sans morbidité.

2. Des procédures opératives différentes sont discutées brèvement.

3. Le roentgénogram était assez typique et les diagnoses différentes étaient considérées.

RIASSUNTO

1. Viene riferito un casi di pancreas anulare, in cui fu eseguita con successo una resezione parziale dell'anello.

2. Vengono brevemente discusse le varie tecniche chirurgiche.

3. I radiogrammi, in tale caso, erano abbastanza caratteristici.

RESUMEN

1. Se comunica un caso de páncreas anular en el cual se hizo sin morbilidad la resección parcial del anillo.

2. Se discuten brevemente los diferentes procedimientos quirúrgicos.

3. Los roentgenogramas fueron muy típicos y se hizo el diagnóstico diferencial.

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The greatest difficulty is that men do not think enough of themselves, do not consider what it is that they are sacrificing when they follow in a herd, or when they cater for their establishment. . . . A man should learn to detect and foster that gleam of light which flashes across his mind from within far more than the luster of the whole firmament without. Yet he dismisses without notice his peculiar thought because it is peculiar. The time will come when he will postpone all acquired knowledge to this spontaneous wisdom, and will watch for this illumination more than those who watch for the morning.

—*Emerson*

The Therapy of Pyogenic Infections of Bones and Joints

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THE therapy of acute and chronic pyogenic infections of bones and joints is still beset with inadequate results, due in many instances to frequently excessive dependence upon antibiotic drugs as a sole agent in the treatment of these lesions. It is true that, as a result of the use of the various antibiotics during the past decade, deaths from acute pyogenic infections have been diminished almost to the vanishing point, and morbidity has been strikingly reduced. Nevertheless there are a number of poor results that warrant attention and study.

It is also readily apparent that the incidence of the hematogenous type of these lesions has become much lower as an incidental result of the prevalent early administration of antibiotics for those diseases which may give rise to infections of bones and joints. Similarly, there is a considerable diminution in incidence of the exogenous form of these lesions as a consequence of the increasing prophylactic use of antibiotics. There appears to be no doubt that present-day shortcomings can be appreciably reduced by correction of the various misconceptions arising from lack of a clear visualization of the pathomechanics of infections of bones and joints and of a clear appreciation of the responses of these lesions to a complete regime of therapy, including the medical components and, where indicated, the surgical components.

It is fundamental with respect to the therapy of pyogenic infections that one must keep uppermost in mind the well established concept that the acute and at times the chronic lesion present a complicated symptom complex which is the result of a varying proportion of the two components of the disease, namely, the systemic disease incidental to bacteremia and toxemia and the local disease, be it suppurative arthritis, an osteomyelitic lesion or even a soft tissue abscess. There is now sufficient evidence that the systemic component of the disease can be obviated provided the offending micro-organism is sensitive to a properly chosen and adequately administered antibiotic, and the toxemia is not overwhelming, since preformed toxins are not influenced by antibiotics and must therefore be dealt with by the patient's defensive mechanisms. In contrast to the foregoing comments, it is just as clear that under similar circumstances the local component of the disease, if it is acute, may or may not be eliminated; and if it is chronic, antibiotic therapy alone will rarely if ever eradicate the disease. This variation in response to antibiotic therapy is due to the character of the pyogenic lesion.

The acute hematogenous osteomyelitic lesion arises as a local inflammatory process during the course of a blood-borne bacterial invasion and in response to the rapid multiplication of the micro-organisms and the production of exotoxins, leukocidins, hemolysins, and spreading factors, suppuration and abscess formation develop. A walling-off process sets in

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early in the form of peripheral thrombophlebitis and thromboarteritis, while the central area of the focus undergoes necrosis and suppuration. An additional important consideration in this process is that the abscess develops in rigid-walled surroundings and the resultant accumulation of pus under pressure aids in the growth of the lesion by interference with the blood supply in the adjacent metaphysial and subperiosteal areas. When these phenomena—peripheral thromboarteritis, thrombophlebitis, and the avascularity arising from the pressure of the growing abscess —are viewed in the light of antibiotic therapy and, for that matter, in the light of chemotherapy or serotherapy, it becomes readily evident that these therapies must fail because of the inability of the blood stream to deliver the therapeutic agents into the focus of disease so as to make them effective. In view of these considerations, the mere administration of antibiotics, no matter how well chosen or how well administered, will not be effective in the eradication of the lesion once it has become sufficiently well developed. On the other hand, very early administration of antibiotics, before the full development of the aforedescribed phenomena has been reached, will result in the prevention or abortion of these lesions, thus accounting for the present-day decrease in the frequency of acute hematogenous lesions and their subsidence during the early stages of the disease.

It therefore follows that rational treatment of the acute hematogenous lesion should provide for the administration of a suitable antibiotic at the earliest possible moment. Subsidence of the systemic manifestations of the disease should not lull the medical attendant into the belief that the local lesion also is being effectively overcome unless the local signs and symptoms likewise subside. Persistence of local pain, tenderness, and swelling, notwithstanding the subsidence of temperature elevation and improvement of the general condition, warrant surgical intervention in a matter of days after the onset of the lesion, rather than weeks. Nor should one await roentgenographic changes before surgical intervention is undertaken in conjunction with antibiotic therapy. The operation should be performed under tourniquet control when possible and should consist of an incision along anatomic planes and decompression of the bone lesion, regardless of whether or not pus is encountered in the soft tissues or subperiosteally. Excessive decortication or curettement of the focus should not be done. The focus should be thoroughly flooded with physiologic solution of sodium chloride containing a high concentration of the antibiotic as it is closed firmly with several layers of sutures, without any drainage whatsoever. Immobilization is obtained by the use of a compression bandage of sheet wadding, flannel and adhesive tape. The wound is not disturbed until the tenth postoperative day, at which time it will be found to have healed *per primam*. Antibiotic therapy is usually continued for a minimum of four weeks after the operation.

Postoperative roentgen studies will reveal the gradual obliteration of the surgically created defect, with diminishing evidence of disease activity. Eventually the bone will present a completely normal appearance. The clinical recovery is just as thorough. Only under such circumstances can one feel assured that the lesion has been eradicated.

The prophylactic administration of a suitable antibiotic is effective in preventing the acute exogenous form of osteomyelitis arising as a complication of surgical procedures on bones and joints. Once infection gets a foothold, the walling-off process effectively prevents penetration of the antibiotic into the focus of disease,

because the local pathomechanic pattern is similar to that of the acute hematogenous osteomyelitic lesion. Once infection is fully developed and suppuration has occurred, incision of the area, evacuation of the focus, including all foreign materials, excision of the soft tissue scar and closure under antibiotic control without drainage is most conducive to prompt healing *per primam.*

In case the acute exogenous form of osteomyelitis arises as a complication of a compound fracture, the successful use of antibiotics as the sole means of therapy is hampered by the nature of the pyogenic lesion and by the added factors incidental to the presence within the wound of avascular devitalized tissue, resulting from the primary injury, and the probable presence of foreign bodies, neither of which can be penetrated by the antibiotic, whether it is delivered into the focus via the blood stream or by local application. It is therefore essential that, in addition to the administration of a suitable antibiotic, débridement be carried out at the earliest possible opportunity, the parts restored to as close to normal as is feasible under the circumstances, the wound closed without drainage and the parts appropriately immobilized. In the event of a frank infection, the wound should nevertheless be débrided under an antibiotic umbrella, so to speak, and closed without drainage as in the presence of acute hematogenous osteomyelitis, with avoidance, however, of local metallic fixation.

Beyond the acute stage of the osteomyelitic lesion the local appearances are relatively similar pathologically, whether the hematogenous or the exogenous form is present, except that the hematogenous form may present multiple lesions and more extensive foci, in contrast to the exogenous form, which is usually a solitary focus probably complicated by mal-alignment, nonunion and the presence of metallic fixation substances. Treatment of all of these lesions is similar, depending upon whether they are in the postacute or the chronic stage.

Clinically the postacute phase, when untreated or inadequately treated, is characterized by low-grade temperature, a slow but progressive downward course, anemia, persistence of draining sinuses, pathologic fractures, deformities, and in severe cases amyloidosis and possibly death. This picture is of course greatly modified and masked by the use of antibiotics. These are the patients who are frequently exposed to successive courses of various antibiotics and at times to multiple antibiotics without relief from the persistent drainage or amelioration of the local lesion, notwithstanding the fact that the general status may be improved by the various antibiotics and the use of blood transfusions. The unfortunate outcome of this mode of therapy is the development of resistance on the part of the offending micro-organisms to the antibiotics in use; the introduction of secondary nuisance invaders that are not affected by the antibiotics in use, and the development in the patient of allergic or other intolerances to the antibiotics in use, to such a degree that no suitable antibiotic may be available when surgical therapy under antibiotic control is undertaken, during either this acute phase or the postacute phase, or later, during the chronic phase of the disease.

The postacute phase is marked by striking roentgenographic changes that depict the pathologic and the reparative changes taking place side by side. The diseased and adjacent areas of the involved bone undergo extensive rarefaction incidental to the inflammatory process. The devitalized portions of the bone, having lost their circulation and having become necrotic, retain their previous calcific contents and are therefore characterized by relatively in-

creased density when compared to the surrounding bone. Concomitant with the development of necrosis there is an attempt at resorption of the devitalized bone. This is usually only partially successful, especially if the necrosis of bone has been at all extensive and is manifested by rarefaction surrounding these areas. The reparative process is further identified by subperiosteal proliferation to form a protective cuff of bone, the involucrum, as a consequence of which the bone becomes thickened and deformed. In addition there is an endosteal reparative process, which produces an intramedullary and interlamellar proliferation of new bone, which eventually results in the obliteration of the adjacent medullary cavity and interlamellar spaces. As the reparative processes progress, the invading granulation tissues undergo fibrosis, with a resultant increased diminution of the blood supply. Enclosed within this newly formed bone scar are larger and smaller areas of infected granulation tissue, accumulations of pus and sequestra. It is at this point, when the involucrum is well formed, the walling-off process is fully developed, the involved bone is well calcified and the sequestrum formation is well defined, that the chronic phase of osteomyelitis begins. The demarcation between the postacute and chronic phases is like the demarcation between the acute and postacute phases, gradual and not well defined. Its recognition is nevertheless therapeutically important and is at times a matter of judgment and experience.

The therapy of the postacute stage is associated with difficulties, in that the administration of antibiotics is under most circumstances inadvisable, as has been indicated. Definitive surgical therapy is beset with great difficulties, in that the mere evacuation of the bone abscess as in the acute stage is insufficient, because of the involvement of the surrounding areas. A thorough removal of the focus, as in the chronic stage, is unwarranted, for in this, the postacute stage, it is impossible to differentiate that portion of the bone which is porotic, incidental to the surrounding inflammatory process which with the subsidence of the process will return to normal, and that which is due to the devitalizing and necrotizing effects of the disease. To attempt the removal of all apparently diseased bone would involve very extensive removal of tissue and would expose the involved bone, in the absence of the protective involucrum, to pathologic fractures and pseudoarthroses. The latter are very real dangers, as is evident from the results following the practice in former days of performing total or partial diaphysectomy during the postacute phase. Furthermore, in cases of the exogenous form accompanied by fracture, with or without metallic fixation, thorough removal of the focus before a sufficient involucrum has developed is likely to result in loss of alignment, deformity and nonunion. In view of these considerations, operative intervention is more advisable early, in the acute stage, or later, in the chronic stage. Beyond that, it is a matter of judgment and experience to determine the advisability of allowing a focus to remain active and institute expectant treatment until such time as the overall process shall be localized and stabilized and the parts protected by a sufficiently strong involucrum.

Chronic osteomyelitis is characterized clinically by the persistence of one or more lesions which appear to heal only to become reactivated from time to time and by the appearance of clinically new lesions which, on roentgenographic study, prove to be of long duration. A clinically active lesion may be associated with general malaise, loss of weight, low temperature, progressive anemia, disability of varying degrees, boring pain, tenderness, redness,

and finally the reopening of a previously healed sinus or the development of a new sinus. This train of symptoms may at times subside without the development of the sinus, or even after its development, without benefit of therapy or during the course of nonoperative therapy of any kind. Other lesions may present a persistently draining sinus with few or none of the symptoms mentioned. There are yet other lesions which are clinically quiescent and present no symptoms whatsover; yet repeated roentgenographic examinations over a prolonged period will reveal progressive extension of the lesion, regardless of its clinical state.

These considerations are of the utmost importance in evaluating the effects of nonoperative therapy. The mere subsidence of clinical symptoms is no indication of the effectiveness of nonoperative therapy, whether it be serologic, chemical or antibiotic, unless it is associated with roentgenographic evidence of the subsidence of the lesion. With the introduction of these various medical modalities there were hopes for results similar to those obtained with lesions other than osteomyelitis, but these met with grave disappointment. The explanation of these variations becomes evident on consideration of the pathologic-anatomic character of the chronic osteomyelitic lesion.

Chronic osteomyelitis is characterized pathologically by the presence of diseased bone and soft tissue covering, showing changes incidental to the processes of destruction and changes incidental to ineffectual attempts at healing. The changes resulting from the processes of destruction are manifested by the presence of cavities, of various shapes and sizes, containing frank pus, infected or indolent granulation tissue, necrotic fibrous tissue, and sequestra, in addition to atrophic bone containing fibrous bone marrow. These cavities may or may not communicate with the surface of the bone or limb through sinus tracts lined with dense fibrous scar tissue. The changes resulting from ineffectual attempts at repair are manifested by subperiosteal and endosteal new bone formation, with consequent partial or total obliteration of the medullary and Haversian canals and irregular thickening of the cortex of the bone. These changes lead to an overall deformation of the involved bone and conversion of the diseased area into an ivory-like mass of dense bone. The periosteal covering of such an involved bone segment is thickened, fibrous and scarred as a result of the long-standing inflammatory process. The soft tissue cloak of such a bone is usually densely cicatrized and poodly nourished, owing to long-standing stasis of blood and lymph incidental to the chronic inflammatory process and frequently to the scars of previous operative procedures and the intermittent healing of sinus tracts.

It is therefore evident that one of the most important characteristics of the lesion is its poor blood supply. The contents of the bone cavities, such as pus and sequestra, are completely avascular, while the surrounding bone scar and dense fibrous tissue elements of the enclosed cavities, sinus tracts, covering periosteum and overall tissue layer are poorly vascularized.

These observations should leave no doubt as to the inadequacy of therapy by the sole means of medicaments that depend on the blood stream for their delivery into the focus of disease. This holds true for all antibacterial substances whose efficiency depends upon intimate contact with the area of disease. The failure of medical therapy notwithstanding the use of potent antibacterial agents leaves no alternative other than excision of the focus for the purpose of eradication of the diseased area to the greatest extent feasible and the revascularization of the site to make possible

the entry of the antibacterial substances for control of the infection.

This leads us to the saucerization procedure, which provides for the most extensive excision of the focus short of amputation and should leave normal and vascularized bone on the surfaces of the resultant cavities. Similarly, the soft tissue scars should be excised as thoroughly as possible, short of interference with the important nerves and vessels of the extremity. This necessity for surgical eradication of the osteomyelitic focus gives rise to the difficult problem of healing the rigid-walled cavity. Of all the methods of healing, that by primary intention is most preferable, for self-evident reasons, and is obtainable in a very large proportion of cases provided several criteria are satisfied in addition to thorough saucerization. Good skin coverage is most important. To obtain this, extensive undermining of the skin edges, with or without releasing skin incisions, may be necessary. The hematoma within the rigid-walled cavity should be thoroughly impregnated with a high concentration of a suitable antibiotic in addition to that supplied via the blood stream. A sufficiently extensive loss of this hematoma may result in failure of healing by primary intention. As a precaution against this, the wound is closed with several layers of sutures and is not disturbed for at least ten days, while the limb is immobilized in a compression bandage of sheet wadding, flannel and adhesive tape. The inclusion of foreign bodies, including various types of bone grafts, for the purpose of obliterating the cavity in a potentially inflected area is an additional challenge toward the control of the infection by the antibiotic and should therefore be avoided. Furthermore, experience has shown that, with few exceptions, there is sufficient bone regeneration to fill the cavity adequately and maintain the integrity of the bone. In those rare instances in which there is inadequate bone repair, bone grafting may be performed later, subsequent to the control of the infection and healing of the primary operative area. The compression bandage is maintained for four or more weeks, and bed rest, for patients with lesions of the lower limbs, enforced for approximately three months.

The limitations of this article do not permit the presentation of statistics or case reports. Suffice it to say that since 1944, when I resorted to the use of primary closure without drainage of extensively saucerized wounds under antibiotic control, I have had a high proportion of cases of healing by primary intention, often under very trying circumstances, of a large number of osteomyelitic lesions. Many of these lesions were rather extensive; some were multiple and of long duration, with histories of many recurrences and exacerbations. Most commonly, failure of healing by primary intention was due to inadequate excision of the bone or soft tissue in proportion to the nature and extent of the lesion, or inadequacy of the surgical technic. Many of these failures were anticipated, because of the probable impossibility of a sufficiently thorough excision. These procedures were nevertheless undertaken with the hope that an amputation could be avoided. Other failures of healing by primary intention arose from a breakdown of the skin coverage. Subsequent skin plastic procedures or skin grafts were therefore necessary to bring about the desired results.

All of these cases have been kept under close follow-up observation. I am therefore in a position to state that the rate of recurrence is much lower than that reported as following other methods of treatment. Some of these recurrences were anticipated because of the inadequacies of the surgical procedures. Nevertheless the overall results are so gratifying that the surgical maxim "once osteomyelitis always

osteomyelitis" may eventually become a thing of the past.

The therapy of acute and chronic pyogenic infections of joints has much in common with the therapy of acute and chronic osteomyelitis. The variations in the therapeutic approach are dependent upon the variations in the pathomechanical nature of these lesions. Acute hematogenous pyogenic arthritis is more amenable to antibiotic therapy without the surgical approach, because the developing abscess does not have the rigid confines of the bony walls observed in its osteomyelitic analogue, and the threat of rapid spread of the lesion because of aseptic necrosis incidental to obliteration of blood supply is nonexistent. Furthermore, the absorptive capacities of joint synovial tissues and their blood stream communications are much more extensive than in the osteomyelitic lesion. In view of these variations, early systemic administration of a well-chosen antibiotic and local therapy by means of repeated aspirations of the joint and instillations of physiologic solution of sodium chloride containing a high concentration of the antibiotic will resolve the lesion. Failure of such resolution, as indicated by the persistent presence of the offending micro-organism within the aspirated fluid, will necessitate the surgical excision of all infected tissues and the abscess wall. This should not be deferred unduly, lest joint function be lost. It should of course be performed under a systemic as well as a local antibiotic "umbrella," and the surgical wound should be closed without drainage.

In my experience, acute hematogenous pyogenic arthritis is a most infrequent lesion. Somewhat more frequent is the acute pyogenic arthritis resulting from contiguous pyogenic osteomyelitis. This lesion most commonly involves the hip joint; on occasion, the knee joint. Early surgical evacuation of the lesion under antibiotic control is essential, lest the circulation to the femoral capital epiphysis be shut off, with resultant sequestration of the femoral head. Here, too, systemic and local antibiotics and primary closure will preserve function if surgical intervention is undertaken early enough.

Chronic pyogenic arthritis invariably involves the adjacent articular surfaces and underlying bone, either primarily or secondarily. In such circumstances surgical intervention under systemic and local antibiotic control, with primary closure, is essential to the eradication of the lesion. With such a procedure, whatever little function may remain in the joint is sacrificed.

The preceding discussion presumes a properly chosen and efficiently administered antibiotic. In the early days of the antibiotic era, there was no choice and the answer was simple—penicillin. With the introduction of the newer antibiotics and increasing experience the answer lost its simplicity. One must now consider the increasing bacterial resistance to the antibiotic, both natural and that developed during the therapy; the increasing patient reactions to the antibiotic, allergic and toxic, and finally the ease of administration of the antibiotic.

A very disturbing element is the fact that, with the increasing utilization of a given antibiotic, the first two of the aforementioned factors become important to such a point that the antibiotic may become less and less useful. New antibiotics will therefore have to replace the old. A complicating factor at the outset of therapy is the frequent lack of data concerning the nature and type of the offending organism and its resistance to the various antibiotics. Though this information is essential to the proper choice of an antibiotic, therapy must be instituted promptly if it is to be most effective. The choice must therefore be made, pending the

availability of more exact information, on the basis of general knowledge concerning the most likely organisms that may be present.

During the past few years, therefore, I have restricted myself to the use of the broad-spectrum antibiotics—chlortetracycline, oxytetracycline, tetracycline, and when the organism happens to be resistant to all of these drugs, carbomycin. For all acute lesions, the drug is administered by mouth as soon as a provisional diagnosis is made—2 Gm. per day, divided into four or eight doses at equal intervals, the 3 a.m. dose being omitted if the patient is asleep. For severely ill patients, an intravenous administration of 500 mg. in 1,000 milliliters of diluent at the outset may be effective. In all chronic lesions as well as in those instances in which the antibiotic is used as a prophylactic agent, the administration of the drug by mouth is started twenty-four hours prior to the operative procedure and continued thereafter as aforementioned. During all operations for acute and chronic pyogenic lesions, 500 mg. of the antibiotic is administered intravenously in 1,000 milliliters of diluent. The chosen antibiotic is also used to wash the operative wound and to flood the various layers as they are closed without drainage, in a concentration of 0.5 mg. per milliliter of diluent for all acute and chronic lesions as well as in clean cases when the drug is used prophylactically. Postoperatively the antibiotic is administered for seven to ten days in prophylactic cases and for four weeks in cases of pyogenic lesions.

SUMMARY

The author outlines the rationale of the therapy of acute, postacute and chronic pyogenic lesions of bones and joints by the use of antibiotics, surgical intervention and primary closure of the surgically formed wounds based upon the pathomechanics of the various lesions. Great emphasis is placed upon the effectiveness of a properly chosen antibiotic during the early phases of the lesion, before the walling-off process has been fully established. Greater emphasis is placed upon the ineffectiveness of a properly chosen antibiotic when used as the sole agent of therapy in the presence of a fully developed acute or chronic pyogenic lesion by reason of the walling-off process, which prevents the delivery of the drug via the blood stream into the disease focus. Stress is also placed upon prevention of the exogenous type of pyogenic lesions of bones and joints by timely use of the antibiotics in conjunction with various surgical procedures.

ZUSAMMENFASSUNG

Der Verfasser erklärt die der Behandlung akuter, postakuter und chronischer pyogener Knochen und Gelenkerkrankungen mit Antibiotika, operativem Eingriff und primärem Verschluss der Operationswunde zugrunde liegenden Gedankengänge auf der Basis des pathologischen Mechanismus der verschiedenen Erkrankungen. Besonderes Gewicht wird auf die Wirksamkeit eines sorgfältig ausgewählten Antibiotikums im frühen Stadium der Erkrankung, bevor es zu einer völligen Abkapselung des Prozesses gekommen ist, gelegt. Noch mehr wird die Tatsache hervorgehoben, dass ein richtig ausgewähltes Antibiotikum als einziges Behandlungsmittel beim Bestehen eines völlig entwickelten akuten oder chronischen pyogenen Krankheitsprozesses unwirksam ist, weil der Abkapselungsvorgang verhindert, dass das Mittel den Krankheitsherd auf dem Blutwege erreicht. Es wird ferner mit Nachdruck darauf hingewiesen, dass die Oxogene Form pyogener Knochen-und Gelenkerkrankungen sich durch rechtzeitige Anwendung der Antibi-

otika in Verbindung mit chirurgischen Eingriffen verhüten lässt.

SUMÁRIO

O autor apresenta as razões para o tratamento de lesões piogênicas agudas, pós-agudas e crônicas dos ossos e das articulações, pelo use de antibióticos, intervenção cirúrgica e fechamento primário das feridas cirùrgicamente formadas, tendo como base a mecânica patológica das várias lesões. É salientada a importância da eficácia do antibiótico devidamente escolhido durante as fases iniciais da lesão, antes que tenha se estabelecido completamente o bloqueio do processo. Maior importância é dada ainda a ineficácia do antibiótico adequadamente escolhido quando usado como o único agente de tratamento na presença de uma lesão piogênica aguda ou crônica inteiramente desenvolvida, devido ao bloqueio do processo, que impede que a droga atinja o fóco de infecção pela corrente sanguínea. É ainda salientada a profilaxia do tipo exógeno das lesões piogênicas dos ossos e articulações pelo uso apropriado de antibióticos, juntamente com vários processos cirúrgicos.

RIASSUNTO

L'autore tratteggia la terapia delle lesioni da piogeni acute, subacute e croniche delle ossa e delle articolazioni mediante antibiotici, interventi chirurgici e riparazione primaria di ferite chirurgiche. Viene data particolare importanza all'efficacia degli antibiotici quando siano scelti con cura, durante la prima fase delle lesioni e prima che il processo abbia stabilito una barriera. Altrettanta importanza viene data all'inefficacia degli antibiotici stessi usati da soli quando la produzione di una barriera infiammatoria impedisca il passaggio di essi dal sangue al focolaio infiammatorio.

Le infezioni esogene delle ossa e delle articolazioni possono essere prevenue con l'uso di antibiotici e di vari mezzi chirurgici.

RÉSUMÉ

Dans sa discussion l'auteur a décrit la thérapie des lésions aigues, post-aigues et chroniques des os et des articulations par l'emploi des antibiotiques, intervention chirurgicale et fermeture primaire des plaies chirurgicales, basée sur la pathomécanique des lesions differentes. Il a accentué la valeur d'un antibiotique, proprement choisi, pendant la première phase de la lésion, avant qu'une barrière complète soit établie. De l'importance plus grande a été posée sur l'ineffectivitée d'un antibiotique, bien choisi, si l'on s'en sert comme seul agent de thérapie en présence d'une lésion purulente aigue ou chronique, complètement developpée, puisque la barrière formée empèche le medicament de pénétrer dans le foyer par passage du sang. Aussi on a mis de l'importance sur la prévention d'une infection purulente exogène des os et articulations par l'emploi précoce des antibiotiques ensemble avec différentes procédures chirurgicales.

RESUMEN

En los comentarios anteriores, el autor ha esbozado los razonamientos terapeúticos de las lesiones piogénicas agudas, subagudas o crónicas de los huesos y articulaciones por el uso de los antibióticos, intervención quirúrgica y cierre primario de las heridas hechas quirúrgicamente sobre las heridas hechas por alguna lesión mecánica patológica. Se da mucha importancia a la efectividad y tipo de antibiótico que debe elegirse durante las primeras fases de la lesión, antes de que se establezca el proceso de tabicamiento. Se llama la atención sobre la efectividad y elección del antibiótico caundo se usa como único

agente terapeútico en presencia de una lesión piogénica completamente desarrollada, aguda o crónica, ya que el proceso de tabicamiento previene el que el antibiótico llegue al foco por la vía sanguínea. También se hace notar la prevención del tipo exógeno de lesiones piogénicas de los huesos y las articulaciones por el uso de los antibióticos junto con con diversos procedimientos quirúrgio.

If Plato and his school may be taken as our guides, they made it clear that the function of the physician was not limited to the study of the body of the patient only, but should include his mind also. Plato put significant words into the mouth of Socrates when he said: "There is no cure for the body apart from the mind. First then, and above all, the mind must be treated if the head and rest of the body are ever to be made whole. . . . Just here the mistake is made in regard to men: the attempt to treat the body independently of the mind." And in another place he says: "The part can never be well unless the whole be well." All disease was, to the Greeks, psychosomatic.

The importance of retaining what are quaintly called the 'psychogenic' factors in general Medicine, rather than segregating them for special study, is greater today even than it was 2,000 years ago. This is so, largely because the doctor is faced less and less with plagues and epidemics resulting from virulent infections from without, and more and more with disease processes due in the main to troubles within. We have exchanged old diseases for new—typhoid fever and sepsis for cardiovascular disease and the psychoneuroses. Our "danger" is, indeed, "being human." The stress comes from within even more than from without, and when we add to this fact another, namely, that personalities differ greatly in their emotional resistance to difficulties in their environment, we see how essential it is to remember the Greek warning.

All the more reason, as I say, for integrating into one whole concept of disease the physical, mental, and environmental factors entering into the patient's condition.

—*Lord Horder*

Safeguards in Angiography

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At this time cerebral angiographic study is conceded to be a valuable diagnostic tool, and, although it has many advantages, it has been shrouded with dark and ominous warnings. Complications in the form of permanent hemiplegia, transient hemiplegia and the decerebrate state have been reported. Death has followed angiographic procedures and has been attributed thereto. Depending on the author, and to some extent the country, the reported incidence of complications ranges from 3 to 10 per cent and the mortality rate from 0.2 to 3.5 per cent. The reports, however, have often represented the first experiences of those reporting. After they had had time to analyze their cases, many of the hazards were eliminated.

When diagnosing the condition of a sick patient, all like to proceed with unhurried steps to the point at which a definite conclusion is reached. Some persons, of whom I am one, dislike being catapulted from one step to another in the care of a patient; we do not like to do long-drawn-out operations, nor do we like to be forced into a position of performing an urgent operation without proper discussion with the patient's relatives and friends.

With regard to brain tumors, it is my opinion that angiography has provided a diagnostic test that largely fulfills these conditions. In most cases accurate localization of a space-occupying lesion can be made, and in some, a close approximation to the histologic picture can be predicted. Proper arrangements with all concerned can be made in the light of the facts brought out by the tests, and, at a convenient time, operation can be performed on a person who has had the chance to rest and recuperate.

That the cerebral angiographic technic is not more widely used is due to reports of complications following its use. These may have been justified in the early days of its use, but now, when the method is properly handled, it appears to be entirely safe. In view of the increasing safety, the prevailing prejudice against it may be entirely withdrawn.

Curiously enough I have had little trouble with routine cerebral angiographic studies and therefore considered it worth while to discuss the method employed. The series is small and consists of the first 150 angiograms taken at the Presbyterian Hospital of Chicago. Ninety per cent of these were done on private patients by me and the other 10 per cent by various residents. All of the patients were given 35 per cent diodrast, and there have been, so far, no untoward effects. I say "so far" because this freedom from complications has not been universally observed by others, and therefore my experience may represent a lucky series.

Method.—Angiograms were taken in a routine manner, in nearly all the cases by one person. This is helpful, because it takes practice to acquire proficiency. In all cases the studies were done with the patient under sodium pentothal-oxygen anesthesia with an intratracheal tube. In nearly all the cases anesthesia was induced and maintained by the same person who anesthetizes for all the other neurosurgical procedures. The patient was transported from the anesthesia room to the roentgen room, where the head was put on a San-

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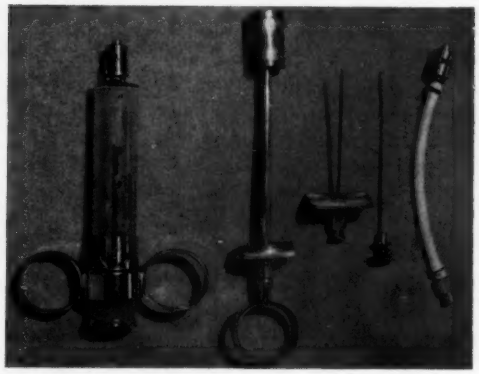
chez-Perez machine. The skin of the neck was prepared and the common carotid artery entered percutaneously between the sternum and the lower border of the thyroid cartilage. The needle was a 2-inch (5 cm.) Lewisholm with a heavy phalange and a short bevel. The great vessels were steadied by the left hand when the needle was introduced. Blood was obtained during withdrawal of the needle rather than during its insertion. When a satisfactory jet of blood was obtained, a short piece of polyethylene tubing, with Luer locks at both ends, was attached to the needle by the operating surgeon, while the nurse attached the syringe. This was a 10 cc. glass syringe with a Luer lock, a metal plunger and rings for the fingers. The syringe was emptied as rapidly as possible of 8 to 10 cc. of 35 per cent diodrast. As the plunger neared the last third of the barrel, the order was given to start the series of plates (see illustration).

The Sanchez-Perez machine is a rapid plate changer and was set to take six plates in five seconds, thus providing a good demonstration of the course of 10 cc. of 35 per cent diodrast through the cerebral circulation, from the arterial through the capillary to the venous phase.

The lateral view was made first as a scout series; if this view revealed no abnormality and unless there was some special problem, anteroposterior views were not taken. Of one-half the patients, however, both lateral and anteroposterior views were taken on one side. This was done in all cases in which a tumor was seen or its presence strongly suspected. In 5 or 6 cases, arteriograms of the common carotid and vertebral arteries were combined on one side. In only a very few cases was *bilateral* common carotid arteriographic study done, and in nearly all of these only lateral views were taken. In 6 aneurysms bilateral arteriographic studies were done, with only a lateral view on the



Needle (18 gauge) with an obturator, used in cerebral angiographic procedures. Needle is 2 inches (5 cm.) long, with a short bevel.

side opposite the aneurysm. No patient was given more than 20 cc. of 35 per cent diodrast on any one side of the brain.

There was usually a delay of three to five minutes between the injections for lateral and anteroposterior views on one side, and about twice that time when two views were taken from the cerebral circulation on the opposite. The time was used in reloading the two sets of casettes. Lateral views were developed and inspected before anteroposterior views were taken. The stylet was replaced in the needle.

Sensitization tests were not employed.

After completion of the final series of pictures the patient was removed to the postanesthesia room to be observed until conscious, when he was returned to his own room.

The procedure is described at an operational level, for the various delays may represent a safety factor.

Tables 1, 2 and 3 summarize the observations in this series of 150 arteriograms.

Table 1 accounts for most of the cases, 25 others representing a variety of different things. Some of the 25 arteriograms were normal, and others showed pathologic changes. The reason for mentioning these things is to discuss not the material

TABLE 1.—*Final Diagnosis (150 Angiograms)*

Cerebral vascular accidents	56
Gliomas	19
Aneurysms	17
Metastatic lesions	12
Meningiomas	10
Cerebellar tumors	5
Chiasmal lesions	4
Chronic subdural hematomas	2
	125
Miscellaneous	25
	150

TABLE 2.—*Cerebral Vascular Accidents*

Cerebral vascular accidents		56
Internal carotid artery thrombosis	5	
Thrombosis of other vessels	5	
Negative	46	
	56	

TABLE 3.—*Data on 150 Cerebral Angiograms**

Patients over 50 years of age	81	
Patients over 60 years of age	27	
Cerebral vascular accidents		56
Internal carotid thrombosis		5
		51
*Of the 51 patients with vascular accidents, were over 50 years of age and 13 over 60.		37

but the dangers of the angiographic method. The type of material is important, however, in that obliterative or obstructive vascular disease is said to be a contraindication to cerebral angiographic procedures. In this group there were 56 with a final diagnosis of cerebral vascular accident of the obliterative or obstructive type. Patients with leaking aneurysms and patients suspected of having cerebral hemorrhages were excluded from the category of those with vascular accidents.

For some reason or other, the age of 50 years has been an arbitrary balance point for angiographic study. For patients over that age the procedure seems to be more dangerous than for those under it. It will be noted that 81 patients subjected to cerebral angiographic study were over 50 years of age, and 27 were over 60. Of these patients in whose cases a diagnosis of cerebral vascular accident was made, 37 were over 50 and 13 were over 60. Altogether, 46 of the patients with so-called vascular accidents did not show anything indicative of any particular disease.

COMMENT

Many papers have been written on the complications of cerebral angiographic investigation, and since it is not my purpose to review the literature I shall mention only two or three, which are reports of observers with approximately the same number of cases and apparently similar clinical material.

In 1951, Dunsmore, Scoville and Whitcombe took 147 carotid arteriograms of 108 patients. There were complications in 14 cases, just under 13 per cent. In 3 cases, the angiographic procedure contributed to the fatal outcome; in 1, from accumulation of blood in the neck leading to respiratory embarrassment, and in 2 from massive infarction of a hemisphere of the brain. The death of these 2 patients was delayed two to twelve days respectively, and the patients were suspected of having vascular thrombosis. There were 4 nonfatal cases in which some permanent neural deficits remained, and 7 cases in which there were transient neural disturbances such as hemiplegia, seizures, thrombosis of the internal carotid artery, injury to the cervical sympathetic chain and sensitivity to diodrast. In the author's opinion, vasospasm played the major role in the causation of complications.

In 1952, Abbott, Gay, and Goodal took 174 angiograms of 150 patients. There were untoward results in 17; 5 deaths; 4 permanent neural deficits and 8 transitory disturbances of the nervous system. This represents a complication rate of 11.3 per cent. Since in many of their first cases they used the open method, they concluded that this contributed various mechanical factors. Vasospasm and several other pos-

sibilities were discussed. Dunsmore and his group used local anesthesia; it is not always clear what type of anesthesia was used for the patients of Abbott and his co-workers. On the other hand, Torkildsen's monograph, in which 2,000 cases are discussed, contains no mention of major complications or deaths. Some or the majority of these investigations were done with perabrodil, which is identical to diodrast. Lima of Lisbon also cited about 2,000 cases without complications, in which thorotrast was employed.

The complications may be divided into two groups: (a) extracranial and (b) intracranial or neural. The extracranial complications are mainly disturbances at the site of injection—hematoma; traumatization of the brachial plexus, the cervical sympathetic chain or the recurrent laryngeal nerves, and painful extravasation of diodrast into the soft tissues of the neck. In attempts to take vertebral angiograms even the subarachnoid space and the spinal cord have been intruded upon. Sensitivity to the diodrast was said to have occurred in 1 case of Dunsmore's and 2 cases of Abbott's. I have not encountered this.

The intracranial complications are much more common and more lethal. They include sudden respiratory failure and death, convulsive seizures and death, and delayed death from massive infarction. The patient may survive but be left with a permanent neural deficit, which usually takes the form of hemiplegia. In the dominant hemisphere this can be a most unhappy situation for all concerned. Frequently, rather severe hemiplegia is superimposed on hemiparesis. Transient hemiplegia or seizures can be counted as relatively mild but alarming complications.

All intracranial complications are more apt to occur in elderly patients, especially in those with obliterative types of vascular disease.

Vasospasm is regarded by most observers as a major factor. Some have thought that mechanical irritation of the carotid sinus produces the vasospasm, and to ward this off they have infiltrated the sinus with procaine. In my own opinion the sinus is not involved, for spasm occurs in the cases in which those who make the studies use local anesthesia. It is almost certain that some of the procaine reaches the carotid sinus when the test is done with the region under local anesthesia. Thus Dunsmore and others, who employed local anesthesia, seemed to encounter as much spasm as did those who chose another method. Preoperative and postoperative papaverine has been used to prevent spasm, and so has infiltration of the cervical sympathetic chain with procaine. Though spasm must have occurred in my cases, there was no clinical evidence of it. The work of Ward and his co-workers has shown that spasm of the blood vessels of the brain is produced by diodrast but that the effect lasts only a few seconds.

The lack of complications in this series of 150 cases may be due to a variety of reasons or a group of circumstances. In such a small series as this, freedom from trouble may be accidental, and if it is, I am thankful. The general method of procedure, however, may be an important factor. In the first place, general anesthesia is always used, and it is deep enough to permit the use of an intratracheal tube. General anesthesia is a vasodilator and thus militates against spasm. In 2 or 3 patients for whom local anesthesia was used, I have been struck by the quick blanching and flushing of the face. This has not been observed in the other patients. The use of the Sanchez-Perez machine completes the entire cycle of cerebral circulation with 8 to 10 cc. of diodrast. The idea is to follow a compact bundle of diodrast through the whole cycle of the circulation, and not to have a long stream of diodrast in the arteries, capillaries and veins at the same

time. The metal plunger on the syringe with the Luer lock is essential to driving a small amount of material quickly into the artery. There is little friction in a metal plunger, and the Luer locks on the intracarotid needle, the tubing and the syringe also help. The tubing makes it possible to lock the unit together without interfering with the needle in the vessel.

The reloading of the machine and the changing of the position of the head for an anteroposterior view takes two or three minutes, but I always wait to see the lateral views before anything more is done. Thus, there is a delay of eight to ten minutes between injections. Since I take the responsibility for the patient and the procedure, I decide whether an injection should be made into the other side or not. No doubt some points of interest may be missed, but if they are the blame rests entirely on me. There is therefore no fixed routine such as someone acting for me might feel the necessity for carrying out. Bilateral arteriograms are rarely taken.

The technic here described may perhaps account for my good luck with angiographic procedures up to the time of this report. I am convinced that angiographic investigation is most valuable in the diagnosis of intracranial lesions and is superior to air studies except in the case of deep-seated expanding lesions near the midline. After the angiogram has been taken the patient may be allowed several days of rest, during which decisions can be reached about the type of operation to be done, and discussions with relatives may be undertaken.

SUMMARY

Angiographic study should be done by the percutaneous method, with the patient under general anesthesia.

The Sanchez-Perez machine affords a complete view of the circulation after one injection of 10 cc. of 35 per cent diodrast. If more than one injection is required, an interval of several minutes should be allowed between injections.

A "constant" team should be used to obtain the maximum efficiency.

Not more than 20 cc. of 35 per cent diodrast should be injected on one side at one sitting, with an interval between injections.

No other precautions were taken in a series of 150 cases in which there were no untoward effects.

ZUSAMMENFASSUNG

Die Angiographie sollte mittels des perkutanen Verfahrens unter allgemeiner Narkose ausgeführt werden.

Mit Hilfe des Sanchez-Perezschen Apparates lässt sich ein vollständiges Bild des Kreislaufs nach einer Einspritzung von 10 cc. einer 35%-igen Diodrastlösung erzielen. Wenn mehr als eine Einspritzung erforderlich wird, soll ein Zeitabstand von mehreren Minuten zwischen den Injektionen eingehalten werden.

Um beste Leistungen zu erzielen, empfiehlt es sich, stets die gleiche eingespielte Arbeitsgruppe die Untersuchung ausführen zu lassen.

In einer Sitzung sollten nicht mehr als 20 cc. mit einer Pause zwischen den Einspritzungen auf einer Seite injiziert werden.

In einer Serie von 150 Fällen, bei der keine weiteren Vorsichtsmassnahmen getroffen wurden, zeigten sich keine unerwünschten Erscheinungen.

RIASSUNTO

L'angiografia deve essere eseguita per via percutanea in anestesia generale. Con l'apparecchio de Sanchez Perez si ottengono dei quadri completi del circolo arterioso, con iniezione di diodrast al 35% nella quantità di 10 cc., eventualmente ripetuto alla distanza di parecchi minuti.

Per ottenere i migliori risultati bisogna sempre servirsi degli stessi collaboratori. Non bisogna iniettare più di 20 cc. della soluzione nella stessa sede, in due volte e con intervallo fra le due iniezioni.

Nessun'altra precauzione deve essere presa; su 150 casi non si è avuto alcun incidente.

RÉSUMÉ

L'Angiographie doit être faite par la méthode percutane, le malade étant en anesthésie générale.

La machine de Sanchez Perez permet une vue complète de la circulation apres l'injection de 10 cc. de 35% de Diodrast. En cas que plusieurs injections seraient necessaires, un interval de plusieurs minutes devait être observé entre les injections.

Une equipe "permanente" devait faire ce travail, afin d'obtenir un succès maximal.

Un maximum de 20 cc. d'une 30% solution de Diodrast devait être injecté dans un coté pendant une session avec un interval entre les injections.

Pas d'autres précautions étaient prises dans une serie de 150 cas sans inconveniences.

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Backed by greater security against shock and sepsis, the ambitious mind of the modern surgeon has surveyed every branch of Medicine and has staked out a claim as wide as pathology itself — a claim that has, however, justified itself again and again. He no longer deals only with the gross effects of injury, with tumors, with acute inflammatory crises, and with the end results of pathological processes; he is the close ally of the physician in taking steps to arrest, in their earlier stages, many diseases which are not amenable to medical measures, or only amenable when these include the imposition of a prolonged and serious restriction upon normal activity, or pursue a progressively disabling course.

—*Lord Horder*

Removal of Pheochromocytoma During Pregnancy

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THE pheochromocytoma is regarded as a rare tumor,[1] and its appearance during pregnancy is infrequent.[2] However, with increased alertness to the labile hypertensions, more of these tumors are now recognized earlier for surgical care even in the presence of the complications of pregnancy. The increased amount of literature concerning the action of the pressor substances[3] epinephrine and norepinephrine and the adrenergic blocking drugs[4] has provided the average practitioner with a better understanding of the behavior of these growths and has aided considerably in the diagnostic study and control of the hypertension crises and their sequelae preceding, during and after surgical intervention.

The surgeon today approaches the problem with greater assurance of success than did the pioneer, Dr. Charles Mayo, who successfully diagnosed and operated on the tumor in the first reported case[5] of pheochromocytoma in May 1927.

Much of the current knowledge concerning the nature of pheochromocytoma has come from research laboratory workers and clinicians, starting about 1929 with Rabin,[6] who reported on "the qualitative estimation of epinephrine in the adrenal medullary tumors."

In 1927, demonstrations of the pressor substance in plasma with attacks of hypertension as reported by Beer, King and Prinzmetal, explained the phenomenal behavior of the blood pressure. Among the important diagnostic tests were the studies on Histamine by Roth-Kvale[8] in 1945; on mecholyl by Guarneri-Evans[9] in 1946; on benzodioxine by Goldenberg, Schneider and Aranow[10] in 1947, and the tests of insensitivity to epinephrine in a patient with functioning tumor of the adrenal medulla by Mayock and Rose[11] in 1949.

Console, Dale and Ray[4] in 1950, made studies on the induction of hypertension with histamine-tea and control with various adrenergic blocking agents, such as dibenamine, priscoline and benzodioxine. In 1951 Isere and others[12] described the use of the adrenolytic drug regitine in pheochromocytoma. At about the same time, Cahill and Monteith[3] made studies on the use of dibenamine and evaluated the action and side effects of norepinephrine and epinephrine for control of blood pressure during and after operation. Their conclusions were that norepinephrine is a more satisfactory pressor substance for the control of hypertension than is epinephrine. Gurling and Heriot,[13] in the *British Journal of Surgery* in 1954, commented on the diagnostic agents, favoring reliance on the assay of urinary pressor amine and the regitine test, considering piperoxine and histamine tests of less value. They contended that tetraethylammonium bromide, mecholyl and dibenamine tests are unreliable and dangerous.

The occurrence of pheochromocytoma during pregnancy was reported by Gowen and others[14] in 1950, and the similarity of this syndrome to that of the toxemia of pregnancy was pointed out in the records

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of 5 cases they had collected and 1 case of their own. Their patient went to term, was spontaneously delivered of a dead baby and died sixteen hours later. In 1951 Schmidt[2] of Germany reported the case of a 34-year-old primipara in her tenth month of pregnancy, who was admitted to the hospital with severe circulatory collapse and died one and a half hours after admission. Since 1951 other cases have been described, the most recent (April 1955) being that of Wallace and McCrary[15] who reported their case as the thirteenth on record of a pheochromocytoma masquerading as preeclampsia.

A search of the literature fails to show a reported case of pheochromocytoma complicating pregnancy in which the tumor has been successfully removed and both mother and fetus have survived. The following report is that of a case of successful removal of a pheochromocytoma from a 32-year-old white woman in the third month of pregnancy, with cure of the patient's symptoms and survival of the fetus.

Operation was performed on Oct. 24, 1951, and on April 12, 1952, patient was delivered of a normal boy weighing 10 pounds and 6½ ounces (4,470 Gm.).

The surgical technic for adrenal tumors has been well outlined in texts on the subject. In this case the transthoracic-retroperitoneal approach at the eleventh rib was elected and gave excellent visualization of an apple-sized, light coffee-colored tumor imbedded in fat and surrounded by numerous engorged veins. The anterior leaf of Gerota's fascia offered an excellent landmark and line of cleavage, permitting the ligation of vessels with a minimum of manipulation. Even this small degree of trauma was responsible for an appreciable rise in blood pressure. The responsibility for control of the circulation was delegated, during the operation, to my medical colleague, Dr. William C. Giordano.

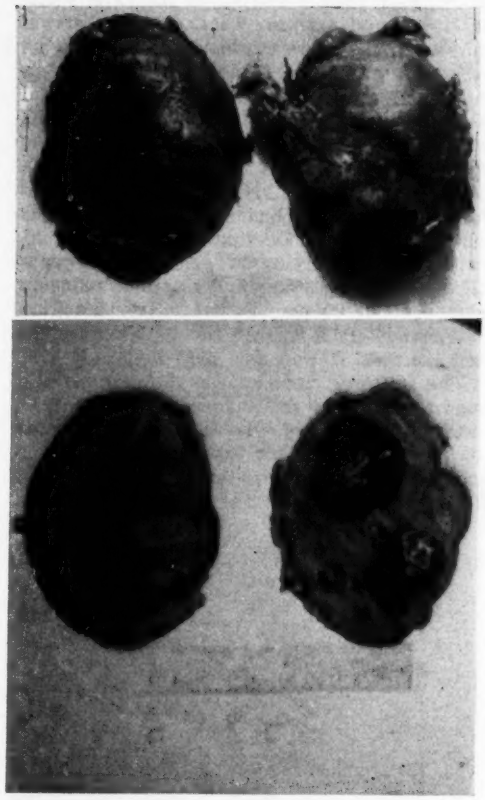

Fig. 1.—*Above*, gross specimen; a light coffee-brown, ball-shaped, well encapsulated tumor measuring 9.5 by 8 by 6 cm. *Below*, cut specimen, showing three cystic cavities filled with blood.

The pathologic specimen (Fig. 1) was not subjected to assay for epinephrine or norepinephrine. The microscopic sections were characteristic of these tumors except for a few areas showing mitotic figures and malignant characteristics (Fig. 2).

REPORT OF CASE

The patient, a 32-year-old white woman, three months pregnant (seventh pregnancy), extremely obese, weighing 213 pounds, (96.6 Kg.) with a buffalo-like neck pad of fat, presented herself in October 1951 for removal of a tumor of the left adrenal gland. Her chief complaints were frequent severe bilateral frontal headaches, perspiration, palpitation,

blurring of vision, roaring in the ears, spells of crying and extreme weakness. She stated that when she was examined during these attacks, an elevation of the blood pressure in millimeters of mercury from 130 systolic and 50 diastolic to 190 and 100, respective was noted. There had been no menses since June 26, 1951.

The patient's past history contained the information that she had had St. Vitus' dance at the age of 7 years, diphtheria at 8 and arrested tuberculosis at 13. At 17, two years after her first pregnancy, the patient suddenly gained about 60 pounds (27.2 Kg.) reaching 187 pounds (84.8 Kg.). Since 1945 her weight had averaged 200 pounds (90.7 Kg.).

The obstetric history was interesting and suggests an early endocrine disturbance.

Obstetric History.—In 1934, at the age of 15, the patient had her first pregnancy; a normal female infant was delivered by forceps. There was edema of the arms and legs. In 1944 a spontaneous delivery occurred, also associated with edema of the arms and legs. In 1947 there was a spontaneous delivery with moderate edema. In 1948 a spontaneous difficult labor took place, with a baby weighing 14 pounds (6,350 Gm.), which died in eighteen hours. In 1949 there was a still birth at nine and one-half months. Delivery was spontaneous, there was a difficult prenatal period associated with a gain of 28 pounds (12.7 Kg.) in weight; there were episodes of dizziness, palpitation and dyspnea. Glycosuria was present but no insulin or diet control was employed. In 1950, there was a stormy course at term. The admission diagnosis was possible toxemia of pregnancy. Unstable blood pressure, perspiration, palpitation, headache, flushing of the face and weakness were observed. A normal baby was delivered by cesarean section on December 5, at which time a tumor of the left adrenal gland was observed. Massage of this area elevated the blood pressure in millimeters of mercury from 120 systolic and 80 diastolic to 190 systolic and 130 diastolic. The adrenal gland was normal.

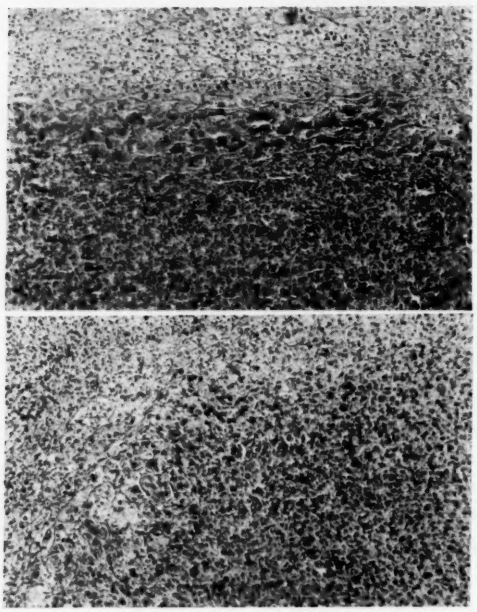

Fig. 2.—Histologic sections showing a tumor composed of rather large cells with large vesicular nuclei and fairly large cytoplasm studded with fine brown granular material. The pleomorphism of the tumor cell nuclei was marked in some places, and miotic figures were frequent. The grossly evident adrenal tissue showed definite invasion of its cortical substance by tumor tissue, and the medullary portion was entirely formed of tumor.

On Oct. 24, 1951, during a subsequent pregnancy (three months) the tumor was removed, with no complications, and an uneventful postoperative course followed for both mother and fetus. The patient was discharged on the eighteenth postoperative day, relieved of her tumor symptoms.

Follow-up history revealed that the patient was delivered at full term on April 12, 1952, by cesarean section, of a normal boy. She has had one additional pregnancy, with delivery by cesarean section at full term of a normal baby. On May 12, 1954, at which time exploration of the adrenal areas showed no recurrence of the tumor and no elevation of the blood pressure.

Physical examination, aside from the obesity, revealed no impressive variations except as noted in the consultations, notes and laboratory reports.

Laboratory Report. — Eyes: The fundi media were clear and the discs normal; the arteries and veins showed slight contraction. The retina was normal.

Urinary Tract. — An intravenous urogram showed normal functioning of both kidneys. The left kidney was tilted. An oblique roentgen film showed a suggestion of an oval mass in the region of the left adrenal gland (Fig. 3).

Thorax. — A chest film showed the heart,

aorta and lungs to be normal. The venous pressure was 142 mg. of water. The circulation time (decholin) was eighteen seconds; ether 12 seconds. An electrocardiographic study showed no significant abnormalities except a large T wave in the limb leads.

Metabolism: The basal metabolism rate was plus 21.

Cold pressor test. — With the patient resting, the blood pressure in millimeters of mercury was 130 systolic and 80 diastolic, on the first immersion, 134 systolic and 84 diastolic, and on the second immersion, 130 systolic and 84 diastolic. The result of this test was considered normal.

Provocative tests: Histamine, 0.0125 mg., gave a positive result. The adrenergic blocking tests with benadine, 20 mg. during a mild crisis of "feeling warm inside" produced little change in blood pressure (146 systolic and 100 diastolic to 139 systolic and 92 diastolic) in twenty-one minutes. The benzodioxine test (8 mg.) was confirmatory. Massage of the tumor during an operative procedure (cesarean section))in 1950 caused elevation of the blood pressure from 120 systolic and 80 diastolic to 190 systolic and 120 diastolic. This examination also disclosed the absence of a tumor on the opposite side.

Laboratory Tests: Urinalysis revealed a 4 plus reaction for sugar and 1 plus for albumin.

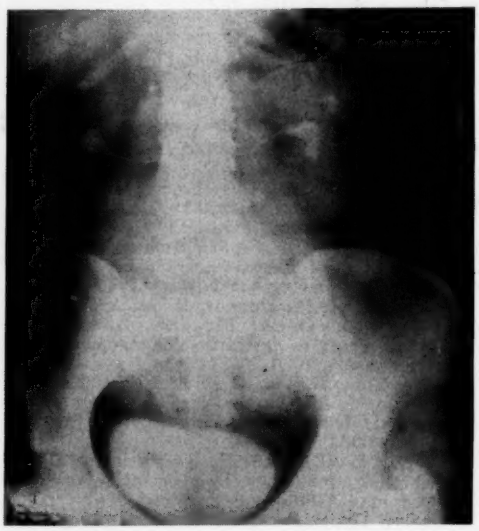

Fig. 3.—Intravenous urogram showing displacement downward of left kidney, with shadow of mass in left adrenal gland.

There was a trace of acetone, with some white blood cells. Culture showed nonhemolytic streptococci. The Friedman test gave a positive reaction for pregnancy.

Blood Chemical Values: The value for blood sugar varied from 100 to 235 mg. per hundred cubic centimeters. The value for plasma protein was 5.22 mg.; for albumin protein, 3.98 mg.; for globulin protein, 1.24 mg. The ratio was 3.2:1.2. The value for cholesterol was 206 mg., that for esters 158 mg. and that for chlorides 447.5 mg. The sodium level was 139.2 milliequivalents and the potassium level 2.93 milliequivalents.

A blood count revealed 4,970,000 erythrocytes per cubic millimeter, with 14.7 Gm. of hemoglobin. The color index was 1.01. The leukocyte count was 15,700 per cubic millimeter, with 69 per cent polymorphonuclears and 31 per cent lymphocytes. The blood gave a Type A positive reaction. A serologic test revealed no abnormality.

SUMMARY

1. A case is presented in which a pheochromocytoma was successfully removed during pregnancy, with survival of mother and child.

2. Preeclampsia or toxemia of pregnancy may easily be confused with this syndrome.

3. The enlistment of a medical colleague to be responsible for the circulation during and after surgery was found essential in this case.

4. The follow-up history shows that normal pregnancies may follow removal of a pheochromocytoma, with delivery of normal offspring.

5. Pathologic study shows that pheochromocytoma may have malignant characteristics.

ZUSAMMENFASSUNG

1. Es wird über einen Fall berichtet, bei dem ein Phäochromozytom während der Schwangerschaft erfolgreich reseziert wurde und Mutter und Kind am Leben blieben.

2. Präeklamptische Zustände oder Schwangerschaftstoxikose können leicht mit dieser Krankheitserscheinung verwechselt werden.

3. Im vorliegenden Falle stellte sich die Mitarbeit eines Internisten, der die Verantwortung für den Kreislauf während und nach der Operation übernahm, als wesentlich heraus.

4. Der weitere Verlauf der Krankheitsgeschichte ergibt, dass die Resektion eines Phäochromozytoms von normalen Schwangerschaften mit Geburt normaler Kinder gefolgt sein kann.

5. Die pathologische Untersuchung ergibt, dass das Phäochromozytom Kennzeichen einer bösartigen Erkrankung tragen kann.

RIASSUNTO

1. Viene presentato un caso di feocromocitoma asportato con successo durante la gravidanza, con sopravvivenza della madre e del feto.

2. I segni con cui si mostra possono essere facilmente confusi con quelli della tossiemia gravidica.

3. Per curare questa malata, durante e dopo l'intervento chirurgico, sopratutto dal punto di vista circolatorio, fu necessario il concorso di un medico.

4. Ulteriori gravidanze normali sono possibili dopo la asportazione del feocromocitoma.

5. Il tumore, dal punto di vista istologico, può avere caratteri maligni.

RÉSUMÉ

1. On présente un cas de Phéochromocytome qui était extirpé d'un femme enceinte. Mère et enfant furent sauvées.

2. La diagnose de praéeclampsie ou toxaemie pendant la grossesse pourrait être confondue avec ce syndrome.

3. La consultation d'un spécialiste en médecine interne pendant et après l'opération était très importante dans ce cas.

4. L'histoire postopérative prouve que des grossesses normales sont possibles après l'excision d'un pheochromocytome et qu'un enfant normal sera mis au monde.

5. L'examen pathologique montre que le phéochromocytome peut avoir une tendance maligne.

RESUMEN

1. Se presenta un caso de extirpación con éxito de un feocromocitoma en una paciente embarazada, con supervivencia de la madre y del niño.

2. La preeclampsia y la toxemia pueden confundirse con este síndrome.

3. Fué necesario el atender a la circulación durante y después de la cirugia, por medio de un colega especializado.

4. La evolución postoperatoria muestra que consecutivamente a la extirpación de un feocromocitoma se produjo un parto normal.

5. El estudio histopatológico muestra que el feocromocitoma puede tener características de mailgnidad.

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Freedom of men under government is to have a standing rule to live by, common to every one of that society, and made by the legislative power vested in it; a liberty to follow my own will in all things, when the rule prescribes not, and not to be subject to the inconstant, uncertain, unknown, arbitrary will of another man.

—Loche

The cause of freedom is identified with the destinies of humanity, and in whatever part of the world it gains ground, by and by it will be a common gain to all those who desire it.

—Kossuth

Depend upon it, the lovers of freedom will be free.

—Burke

Excision of the Cul-de-Sac of Douglas

For the Surgical Cure of Hernias, Through the Female Caudal Wall, Including Prolapse of the Uterus

RICHARD TORPIN, M.D., F.I.C.S.*

AUGUSTA, GEORGIA

TEXTBOOKS still emphasize the role of the pelvic floor, consisting of the levator ani group of muscles and the associated fascia, in relation to uterine prolapse and other herniations through the human female pelvis. A cursory consideration by anatomists or gynecologists must raise some questions since the uterus, bladder and rectum are considerably above the pelvic floor and are obviously not directly supported by it.

More than half a century ago Mackenrodt described the transverse cervical ligaments, but there is not yet agreement among students as to the exact location, composition and function of these and allied structures. Since his studies were published there have been many to advance along the same line, in support of an "upper pelvic diaphragm," so designated by Polk in 1909. Among these students are Sears, Powers and Curtis, anatomists, and many gynecologists, including Moschowitz, Polk, Chipman, Ward, Frank, Bonney, Mengert and Phaneuf. Their contributions have been reviewed in a previous paper.

Curtis[1] and his associates have recently performed exacting dissection of the female pelvis and noted, "The cardinal or transverse cervical ligaments (of Mackenrodt), comprising the contents of the bases of the broad ligaments, are the chief supports of the uterus and upper part of the vagina. They integrate on each side posteriorly with the corresponding uterosacral ligaments and are continuous inferiorly and medially with the cervicovaginal sheath of the endopelvic fascia. The literature is replete with references to these ligaments, but no adequate detailed description of their structure is available. Mackenrodt's original account, correct in any essential, is not fully substantiated by our anatomical dissections. These supports, situated on either side of the cervix and upper vagina, are composed of connective tissue and muscle fibers together with the structures they encase. Each ligament spreads out lateralward, fan-shaped, housing between its two layers the nerves of Frankenhauser's plexus, the uterine artery and the massive parametrial veins. In fact the blood vessels, especially the veins, make up the chief bulk of the ligament. The veins, together with their perivascular connective tissue and elastic fibers, constitute the essential factor in the remarkable pliability and great tensile strength of this most important support. Extending lateralward, the fan-like cellular tissues of the Mackenrodt ligament do not, as commonly assumed, attach themselves to the bony wall of the pelvis; rather, the muscles, connective tissue and elastic fibers of the ligament be-

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come inserted into the fascia overlying the obturator muscles and the muscles of the pelvic diaphragm and, more important, they also continue to follow the course of the major vessels as a supporting framework, becoming gradually attenuated as they leave the pelvis. When dissected carefully it is found that dorsal fixation of all of the ligaments is established chiefly through the perivascular fibrous tissue of the hypogastric and iliac vessels."

Mengert[2] made a unique study, reporting as follows: "1. The experiment was performed on eight female fresh cadavers none of which had uterine prolapse. After attaching a 1 kg. weight to the cervix, the paired structures attached to the uterus were severed in varying sequences and the resulting uterine descent measured. 2. Section of the round, ovarian, infundibulopelvic, and the upper third of the broad ligaments hardly affected the position of the uterus in the pelvis. 3. The pelvic floor (the levator ani group), although it was never incised, did not hinder experimental prolapse of the uterus, and therefore could not have contributed to the uterine support in any of the eight subjects. 4. Section of the parametrial (lower two-thirds of the broad ligament) and the upper two-thirds of the paravaginal tissues allowed an average uterine descent of 10.5 cm. 5. Marked descent of the uterus amounting to actual prolapse never occurred so long as any part of the upper two-thirds of the paravaginal and/or lower two-thirds of the parametrial tissues were intact. Of these two arbitrary divisions of the urogenital fascia propria, the paravaginal tissue seemed to be slightly more important, for its division allowed an average uterine descent of 6.9 cm. as compared with 3.6 cm. following division of the parametrial tissues."

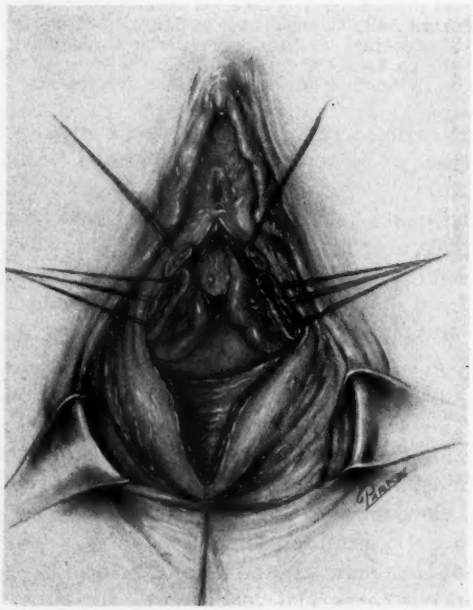

Fig. 1.—Appearance after urethrocele, cystocele and vaginal hysterectomy in a case of prolapse of the cul-de-sac of Douglas. The base of the cul-de-sac of Douglas contains the structures of the posterior plane of the upper pelvic diaphragm.

For practical clinical purpose, then one may assume that the uterus, bladder, cul-de-sac and rectum are held up by fascial, vascular and peritoneal investments in a slinglike structure extending from the pubic bone back to the region of the sacrum and laterally from the cervix as Mackenrodt ligaments. These later diverge and form a flattened fan of fibers to the "arcus tendineus." This supporting sheet of tissue then decussates around the upper end of the urethra, around the cervix and posteriorly around the rectum. It acts as the floor of the cul-de-sac of Douglas. In addition, there is considerable supporting effect of the vaginal tube, with its fascial planes between the bladder anteriorly and the rectum posteriorly, and of course an intact pelvic floor is necessary.

Chipman[3] aptly described the condition: "The uterus may be considered as sitting in a swing, the seat at the level of the isthmus. The body above, clothed in peri-

toneum, is steadied in this seat by the peritoneal fold of guyropes. The cervix, however, projects below the level of this seat and hangs within the vaginal vault. Still below this cervix, and closing the pelvic outlet, is the muscular layer of the pelvic floor. This affords some additional support to the uterine cervix. The analogy is that of a person seated in a swing, steadied therein above and with a definite footrest below."

Herniation through the female pelvis includes one or more of the structures—urinary bladder, cervix (with or without the fundus), cul-de-sac of Douglas and at least part of the rectum. When the uterus is in normal anteversion and the cervix is held back by the uterosacral ligaments, increased intra-abdominal pressure has a tendency to fold the uterus over the anterior vaginal wall without straining the holding structures. When the uterus is retroverted there is more tendency for it to become invaginated in the upright vagina, and retroversion may be the precursor of prolapse in many cases.

The immediate etiologic factors, as previously discussed, fall into three categories:

1. Childbirth injuries due to stretching the cervical opening of the upper pelvic diaphram and the separation of the pubococcygeus muscle, with laceration of the lower vagina.

2. Stresses and strains, such as lifting, chronic coughing, asthma, and constipation or other sources of increased intra-abdominal pressure (fluid, cysts, etc.).

3. Constitutional factors, including the hereditary; occult spina bifida, and large pelvic cavity. The smaller size of the Negro pelvic inlet may account for a somewhat lessened incidence in that race.

This paper does not deal with operations for cystocele or urethrocele or perineorrhaphy *per se*, yet complete success depends much upon exacting and individual

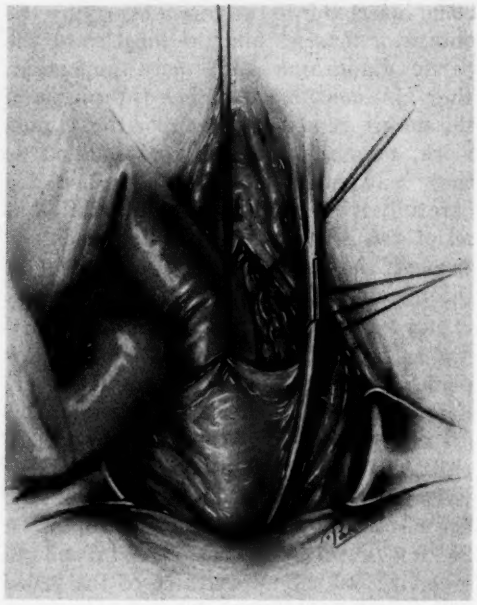

Fig. 2.—The cul-de-sac is palpated and the rectal wall pushed back. This shows the location of the curved Kelly forceps noted in figure 3. It is often of advantage to grasp the tissue through-and-through by a tenaculum at the point of proposed junction of the end of the forceps.

attention to details in the performance of these operations. It may be stated that a carefully executed perineorrhaphy with adequate building up of the perineal body may lengthen the vagina 2 to 3 cm., overcoming any tendency toward shortening from possible scar tissue at the vault.

Innumerable operations have been devised for the cure of these herniations, including uterine prolapse and enterocele. The abdominal operations formerly employed were not too successful, and now most of these conditions are attacked from below, since cystocele, urethrocele or perineorrhaphy then become an integral part of the operation and help in returning the pelvis to normal conditions.

The operation herein described has the advantage of fitting in with these other repair operations, including vaginal hys-

terectomy; of being universally applicable to any type of depressed cul-de-sac; of being easily learned by the occasional operating surgeon, and of being as successful, probably, as any other that may require more dissection and a greater degree of skill. All of these vaginal operations are plastic, and plastic procedures in any case are rather exacting if good anatomic, functional and cosmetic results are to be assured. The operation is done after every vaginal hysterectomy in which a finger in the peritoneum of the cul-de-sac of Douglas is able to depress the bottom of the sac to a level with the introitus. This is the case in approximately one-sixth of all vaginal hysterectomies. Thus far all enteroceles *per se* also have been treated by this procedure.

Prior to the use of this operation in 1938 it was noted that occasionally the vaginal vault in a patient previously subjected to vaginal hysterectomy would, on increased intra-abdominal pressure, descend as a bulging mass into a partially opened bivalve speculum. Some of the patients have backache and a "bearing-down" feeling, and in a few there develop enteroceles that protrude from the introitus. Gynecologists encounter many such cases. Several patients of this type were apparently cured by this simple procedure plus an accurate perineorrhaphy after several other kinds of operation had been unsuccessful.

Technic of Excision of the Structures Forming the Cul-de-Sac of Douglas.—With the vaginal vault opened into the peritoneal cavity after hysterectomy (or through a postcolpotomy incision in those instances in which the uterus is to be retained), the redundant tissues, perito-

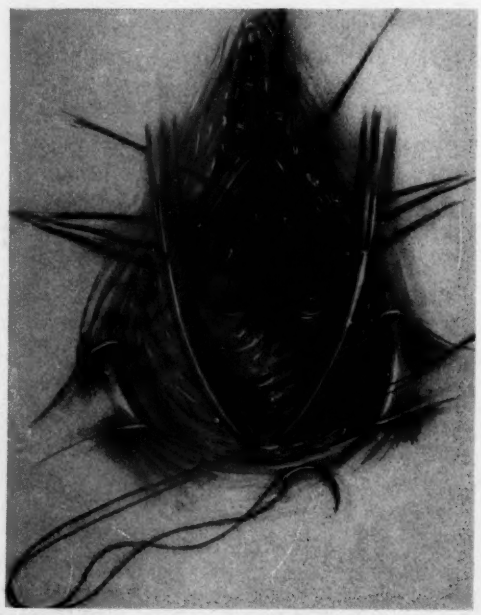

Fig. 3.—The curved Kelly forceps applied at the lateral aspects of the cul-de-sac grasping all three tissues—peritoneum, fascia and excessive vaginal vault wall—being certain at the same time that the rectal wall is not caught.

Fig. 4.—A tight ligature with double gut suture is placed and tied around the tissue beyond the ends of the forceps; the loose end is held centrally while the long end is sutured in spiral fashion around the forceps from side-to-side.

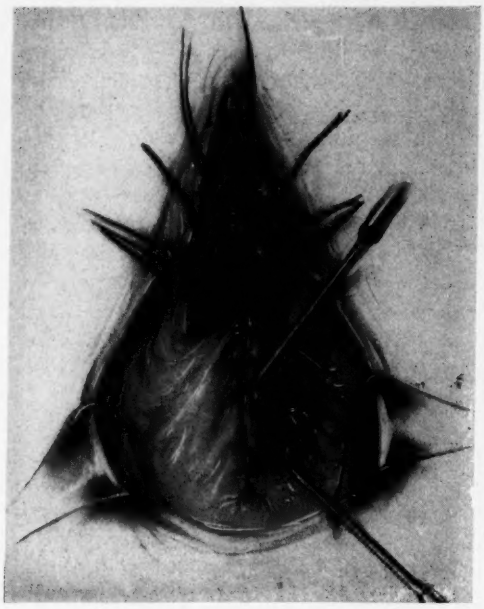

Fig. 5.—After removal of the forceps the coils of spiral double sutures are pulled tight by dissecting hooks as illustrated. The ends of the suture are held taut.

neum, fascia and vaginal vault are grasped by the surgeon's fingers placed in the cul-de-sac. The rectum is pushed back between the thumb and forefinger. This allows visualization of the triangular section composed of the three structures, the anterior boundary being the cut surface. A curved Kelly forceps is then placed on each side, with the convex surface of the forceps toward the lateral wall on each side of the triangle. The points of the forceps meet just anterior to the rectal wall. The triangular section of tissue composed of peritoneum, fascia, and vaginal wall is then excised with scissors. This section usually measures 1 inch (2.5 cm.) on each side of the triangle but may be as much as 3 inches (7.5 cm.) on occasion. The two exposed sides of the cul-de-sac, fascia and vaginal vault are then firmly sutured together with a double gut suture, as follows: Beginning at the apex of the triangle and behind the points of the forceps, the tissue is ligated and a tight knot placed. The short end of the suture is held, and the suturing is continued from side to side back of each clamp until the continuous spiral suture has reached the anterior surface of the cul-de-sac. With both sutures held taut, the forceps are removed and, with special blunt tenaculum hooks, each loop is tightened. Further plication and hemostasis are obtained by tying together the two ends of the doubled suture.

This operation excises the peritoneal sac as well as the excessive fascia of the posterior portion of the upper pelvic diaphragm and the redundant wall of the vaginal vault. Thereby the peritoneal sac is obliterated, the concavity of the upper pelvic diaphragm is reduced and, when sutured, the uterosacral ligaments are approximated and the diaphragm elevated. The vaginal vault is narrowed without decreasing the length of the vagina. The vaginal vault is held up because it is firmly attached to the elevated upper pelvic diaphragm. The time required for this relatively simple operation is ten to fifteen minutes and it may be used advantageously in association with any other procedure, including vaginal hysterectomy, the Manchester operation, etc., plus anterior and posterior perinorrhaphy.

The potential dangers lie in injury to the rectum or in postoperative hemorrhage, neither of which occurred in these series. The rectal wall is easily palpated and pushed back. The double gut permits hemostatic closure of the suture line without danger of breaking the suture material.

Forty-four patients, 38 white and six Negro, comprised the first group[4] reported on in the years 1938 to 1946 inclusive. In the subsequent group there were 135 patients, of whom 114 were white women and 21 were Negresses, although the numbers of gynecologic patients in the two

races are approximately equal.

Most of them were either private or staff patients at the University Hospital, but 23 of the histories were supplied from the practice of Jule Neal, a former resident, practicing in Macon, Georgia; 8 cases were from my service at Milledgeville State Hospital, 4 from the practice of W. P. Smith, formerly of that hospital, 1 from the practice of William Boyd, former resident at the University Hospital, and 1 from the practice of a former resident, Bothwell Traylor, Athens, Georgia.

The year of operation and the age distribution are given in Tables 1 and 2.

On 105 patients, in addition to wedge excision of the cul-de-sac, operations for cystocele and urethrocele, vaginal hysterectomy and high perineorrhaphy were done. All of the operations except that for rectocele were performed on 8. Six patients had no record of operations other than vaginal hysterectomy and cul-de-sac excision. Two, in addition to the five operations mentioned, had undergone repair of a third degree tear. In 3 the wedge-shaped portion of the cul-de-sac had been removed at time of abdominal hysterectomy and from above. Seven had undergone all of the vaginal operations except hysterectomy, since true enteroceles had developed after a previous hysterectomy. Two others followed subtotal hysterectomy. In 1 case only was the cul-de-sac operation done solely to relieve third degree retroversion.

In Milledgeville State Hospital a considerable number of large enteroceles associated with prolapse of the uterus were encountered among the 11,000 psychiatric patients. Twenty of these have been operated upon, half of them by the simpler Lefort colpocleisis. Study of the 10 subjected to wedge excision of the cul-

TABLE 1.—*Number of Patients Operated on per Year in Current Groups*

1946	2
1947	26
1948	16
1949	8
1950	10
1951	15
1952	29
1953	29

TABLE 2.—*Ages of Patients by Five-Year and Ten-Year Periods*

Age Groups		
21-25	5	19
26-30	14	
31-35	18	41
36-40	23	
41-45	20	34
46-50	14	
51-55	11	20
56-60	9	
61-65	6	12
66-70	6	
71-75	2	2
76-80		
Unknown	7	

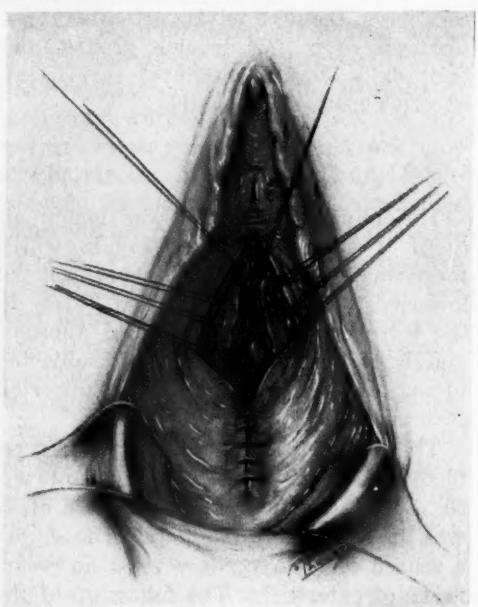

Fig. 6.—When the suture ends are tied the incision is hemostatic and shortened as illustrated, completing the cul-de-sac excision operation. The broad ligament stumps are sutured to the vaginal vault and the incisions are closed as in any vaginal hysterectomy. High perineorrhaphy completes the repair of the floor.

de-sac revealed no bulging down on pressure of the vaginal vault in 8. One had moderate bulging in the apex of the vagina, and 1 had a lemon-sized mass that presented above the introitus. This was thought to represent a recurrence, but at reoperation it proved to be composed of a mass of fat tissue, which was dissected out without opening the peritoneal cavity, which remained high.

One staff patient aged 41, gravida 5, para 3, underwent operation on Oct. 6, 1947. She had the only known recurrence in both series, with formation of a true enterocele, which bulged as a lemon-sized mass outside the introitus. She was reoperated upon in 1953 by a surgeon who chose the abdominal approach.

In no case of my own or of former residents was there known injury to the rectum or known hemotoma in this region. William Boyd, former resident, reported having done more than twenty-five such operations, all successful in preventing or curing enteroceles. In 1 of his patients thrombophlebitis developed and was treated with anticoagulants. The patient thereupon had a prolonged hemorrhage from this region requiring 8 pints of blood to replace; she recovered. Two white patients, aged 45 and 50 respectively, have had recurrent cystoceles, which were operated on within six months after the original operation.

One white patient, aged 44, bled from necrotic tissue at cut edges of the broad ligaments two weeks after operation and again two weeks later. Transfusions, antibiotics and firm vaginal packing were effective, and the final healing was complete. Another white patient, aged 37, bled on the day of operation from an unligated artery in the anterior vaginal incision of the cystocele. This was closed by single suture. Another, aged 42, had tenderness in the cul-de-sac scar on pressure for six months or so.

None had a vagina shorter than 8 cm.; therefore the full introduction of a medium-sized Graves speculum was possible. An accurate perineorrhaphy with built-up perineum usually returns the vagina to nulliparous length, diameter and external appearance.

The high incidence of vaginal hysterectomy in this group of women, some of whom were rather youthful, was due to the presence of long-untreated chronic cervicitis, with infection of the broad ligament and the attendant debility. All of these were subjected to prolonged conservative therapy before operation was advised. The period of such treatment was usually one year, and the therapy included cervical cauterizations and hot douches taken in the recumbent position. In no instance was hysterectomy done if more children were desired or further pregnancies were thought advisable. Many patients were in low income groups, and their daily work necessitated cure by an effective method if possible.

SUMMARY

The cul-de-sac operation was done in all cases of vaginal hysterectomy in which there was redundancy of tissue so that the lowermost depression extended nearly to the introitus. This occurred in approximately one-sixth of the patients subjected to vaginal hysterectomy during the period covered.

The follow-up studies were not as complete as desired. Until recently, however, the hospital from which they were made was the only one in the neighborhood, and a search of the records reveals no recurrence of enterocele. The follow-up of the staff patients was less exhaustive than that of the private patients. Most of them were symptom-free, which was a factor in failure to secure adequate follow-up studies, especially of the staff patients.

The average postoperative stay in the hospital was nine days. There was one death in the first series but none in the current one.

Author's Note: Appreciation is hereby extended to the residents named below for follow-up studies and review of charts: David G. Stroup; C. A. Burgamy; L. Richard Lanier; James M. Skinner; Frank Story; E. J. Reily and Wallace Gibson.

ZUSAMMENFASSUNG

In allen Fällen von vaginaler Gebärmutterresektion, bei denen soviel überflüssiges Gewebe vorhanden war, dass der tiefstgelegene Punkt fast bis zum Scheideneingang reichte, wurde di Cul-de-sac-Operation ausgeführt. Dies kam bei ungefähr dem sechsten Teil aller Patientinnen, die während des hier erörterten Zeitraumes einer v a g i n a l e n Gebärmutterresektion unterzogen wurden, vor.

Die Nachuntersuchungen waren nicht so vollständig wie wünschenswert wäre. Das Krankenhaus, in dem die Operationen ausgeführt wurden, war aber bis vor kurzem das einzige in der Gegend, und eine Durchsicht der Akten ergab keine Rückfälle von Darmbrüchen. Die Kontrolle der Klinikpatienten war weniger komplett als die der Privatpatienten. Die meisten Patientinnen, besonders unter dem klinischen Material, waren beschwerdefrei, und diese Tatsache ist zum Teil dafür verantwortlich, dass nicht genügend zuverlässige Nachuntersuchungen ausgeführt wurden.

Der durchschnittliche Krankenhausaufenthalt betrug neun Tage. In der ersten Krankenserie kam ein Todesfall vor, keiner jedoch in der augenblicklichen Serie.

RÉSUMÉ

L'opération du cul de sac était faite dans touts les cas d'hystérectomie vaginale, oû le tissu était abondant, de sorte que la dépression la plus profonde s'étendit presque à l'introitus. Cela se passa à peu près à une entre 6 patientes, soumises à la hystérectomie vaginale pendant le temps de l'observation. Les études postopératives n'étaient pas si complètes qu'on pourrait désirer. Tout de même jusqu' à present cet hôpital est le seul dans le voisinage, et dans les histoires on ne trouve aucun récidive d'enterocèle à aucune malade. L'observation postopérative du staff était moins complète que celle des patientes privées. La plupart d'eux n'avait pas de symptômes. C'est par cela que les observations postopératives étaient insuffisantes, spécialément celles des patientes du staff.—La durée postopérative était de 9 jours en moyenne à l'hôpital. Il y avait un cas de mort dans la première series, nul dans la presente.

SUMARIO

A operação de fundo de saco foi feita em todos os casos de histerectomia vaginal en que havia excesso de tecido, estendendo-se a região de maior depressão até próximo do introitus. Tal fato se deu em aproximadamente um sexto des pacientes submetidas à histerectomia vaginal durante o período em estudo.

O follow-up não foi tão completo quando aconselhável. Contudo, até recentemente êste Hospital era o único das vizinhanças e a revisão das fichas não demonstrou recidiva da enterocele em qualquer das pacientes. O follow-up das doentes da clínica particular foi mais completo; a maioria delas não apresentava sintomas, fator responsável pela falha do follow-up, principalmente em doentes de enfermarias.

A permanência média das pacientes no Hospital foi de 9 dias. A primeira série registrou um óbito e a atual nenhum.

RIASSUNTO

Venne eseguito l'intervento "a cul-di sacco" in tutti i casi di isterectomia vagi-

nale in cui vi era sovrabbondanza di tessuto, e cioè in circa un sesto delle donne sottoposte ad isterectomia vaginale.

I controlli a distanza non sono stati fatti in maniera esauriente, tuttavia non si è trovata alcuna recidiva di enterocele. I controlli eseguiti sulle malate di sala furono meno completi di quelli sulle malate private; la maggior parte di esse stava bene.

La durata media di degenza in ospedale fu di 9 giorni; vi fu un caso di morte nel primo gruppo, nessuno nel secondo.

RESUMEN

Se hizo la operación del fondo de saco de Douglas en casi todos los casos de histerectomía vaginal en los cuales se encontró redundancia de tejido que en su parte más inferior se extendía casi hasta el vestíbulo de la vagina. Esto se presentó en un sexto de los pacientes sometidos a histerectomía vaginal durante cierto período de tiempo.

El control postoperatorio no fué como se hubiera deseado. Sin embargo, hasta recientemente, en el suburbio no se ha registrado ningun enterocele postoperatorio y el Hospital es el único en el suburbio. El control postoperatorio de los pacientes del "staff" fué menos completo que el de los pacientes de la clientela privada, la mayoría de los cuales se encontraban sin sintomas.

La estancia promedio en el hospital fué de nueve días. En la primera serie no hubo ninguna muerte, mismo que ha sucedido hasta la actualidad.

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There is a book into which some of us are happily led to look, and to look again, and never tire of looking. It is the Book of Man. You may open that book whenever and wherever you find another human voice to answer yours, and another human hand to take in your own.

—*Besant*

Man must cease attributing his problems to his environment, and learn again to exercise his will — his personal responsibility in the realm of faith and morals.

—*Schweitzer*

Technic of Approach to the Major Pancreatic Duct (Wirsüng's Duct)*

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IN recent years, realization of the importance of the pancreatic ducts, their branches and anastomoses, in elucidating pathologic changes in the pancreas, has increased, especially with the advent of surgical pancreographic technic and with catheterism through the papilla of Vater. Perfect catheterization, from the anatomic and functional point of view, is hindered by the pathologic processes of this complex region. Therefore, other approaches to the major pancreatic duct, for drainage or for the introduction of a contrast medium, are of interest.

On opening the anterior wall of the abdominal cavity, the major pancreatic duct is reached by: (a) duodenotomy at the level of the major duodenal papilla and catheterization of the duct; (b) freeing of the duodenopancreas from its membranes of peritoneal coalescence, and dissection, at the posterior aspect of the pancreatic head, the juncture of the choledochus and the major pancreatic duct; (c) puncture of the pancreas, with perforation of the major pancreatic duct, followed by aspiration and contrast injection, and (d) the transpancreatic approach, to be proposed in this paper.

The present study is based on simple dissection of anatomic specimens and pancreographic studies performed on cadavers.

Exact knowledge of the topographic aspects of the duct at the level of the pancreatic neck, together with the execution of pancreographic procedures by dissection of the duct at this level, enable me to propose this approach for the following purposes: 1. To perform operative and postoperative pancreographic studies. 2. To drain the ducts and obtain pure pancreatic juice. 3. To dissect the duct at this point for anastomoses and reimplantations after partial resection of the pancreas.

Material and Methods. — The material for this study consisted of (a) simple dissections of the major pancreatic duct at the level of the pancreatic neck, and (b) pancreographic studies performed on cadavers by means of dissection of the duct at the level of the pancreatic neck and injection of a contrast medium into the pancreatic ducts.*

1. Simple dissection was done in 200 identified specimens of 100 more or less pure Negro (59 male and 41 female) and 100 white (75 male and 25 female) of different nationalities, mostly adults. These specimens were obtained from autopsies, fixed in 10 per cent solution of formaldehyde and posteriorly reduced. The topographic aspects of the duct were examined at the level of the neck of the pancreas.

2. Pancreographic studies were made on 6 identified adult cadavers, fixed in solution of formaldehyde or kept in the cold chamber. The ages ranged from 50 to 78 years. Five were white (4 men and 1 woman) and 1, a woman, was Negro. The anterior wall of the abdomen was opened by a cross incision. The great omentum (epi-

*Abridgement of paper approved by the Academia de Medicina de Sao Paulo for membership, Dec. 1, 1954. Submitted for publication Feb. 2, 1955.

*Under the sponsorship of Prof. Odorico Machado deSousa, dissections and pancreographic studies were made in the Department of Descriptive and Topographic Anatomy, Faculty of Medicine, University of Sao Paulo (Director, Prof. Renato Locchi).

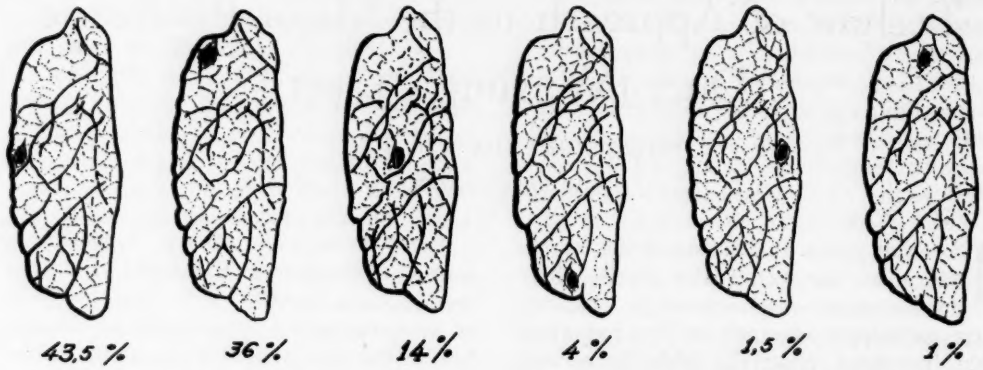

Fig. 1.—Sagittal section of the isthmus of the pancreas, showing the topographic aspect of the major pancreatic duct. *Left*, posterior aspect; *right*, anterior aspect (See text).

ploön) was dissected by being freed peritoneally from the transverse colon, which gave access to the retrocavity of the epiploön and the anterior aspect of the pancreas. The isthmus, the narrow portion between the head and the body of the pancreas, was identified. The covering serosa was sectioned on the anterior aspect of the pancreas, the major pancreatic duct being reached by a 1 cm. perpendicular incision on the median portion of the anterior aspect of the isthmus. Small sectioned confluent ducts were ligated with thin cotton, so as to avoid extravasation of the contrast medium. The duct was punctured with a thin needle, and 3 to 5 ml. of uroselectan B (iodate aqueous solute) was injected.

These procedures were followed by immediate roentgenographic studies under the following conditions: height of ampule, 75 cm; time, three and one-half seconds; apparatus, Westinghouse simplex (25,000 amperes, medium power 75 kilovolts).

The pancreatic ducts were dissected in their anatomic position, their disposition being registered for comparison with the roentgen features.

Results.—The results of simple dissection of the major pancreatic duct at the level of the pancreatic neck were as follows:

The duct ran close to the posterior aspect of the pancreatic neck, near to its superior border, in 36 per cent of the cases (Fig. 1*B*); near to the posterior aspect in the mesial portion in 43.5 per cent (Fig. 1*A*), and close to the posterior aspect, near the inferior border, in 4 per cent (Fig. 1*D*). It ran close to the anterior aspect and equidistant from the borders in 1.5 per cent of the cases (Fig. 1*E*). The duct was close to the superior border of the pancreas, equidistant from the borders in 1 per cent of the cases (Fig. 1*F*). It was in the center of the isthmus, equidistant from the margins in 14 per cent (Fig. 1*C*).

The frequency of each different type in relation to race and sex is shown in the accompanying table.

Pancreograms show that injection of the contrast medium into the major pancreatic duct, at the level of the pancreatic neck, allows visualization of the ducts from head to tail, showing the entire pancreatic tree and sometimes revealing the outline of the duodenal mucosa and the choledochus, according to the type of ending of the two ducts (Fig. 2).

Transpancreatic Approach to the Major

Pancreatic Duct (Wirsüng's Duct).—The essential surgical stages of the proposed approach are as follows: 1. Opening of the abdominal wall. 2. Opening of the retrocavity of the epiploöns through the large or the small epiploön. 3. Section of the peritoneum covering the pancreas. 4. Section of the pancreatic tissue at the level of the anterior aspect of the pancreatic neck. 5. Dissection of the major pancreatic duct. 6. Puncture and injection of the contrast medium. 7. The roentgenographic study and its interpretation.

1. For operations on the viscera of the supramesocolic region (level), cutaneous incision and dissection of other elements are chosen by every surgeon.

2. The retrocavity of the epiploön is reached by (a) intercolonicopiploic dissection at the level of peritoneal coalescence; (b) section of the great epiploön with ligature of the vessels, or (c) section of

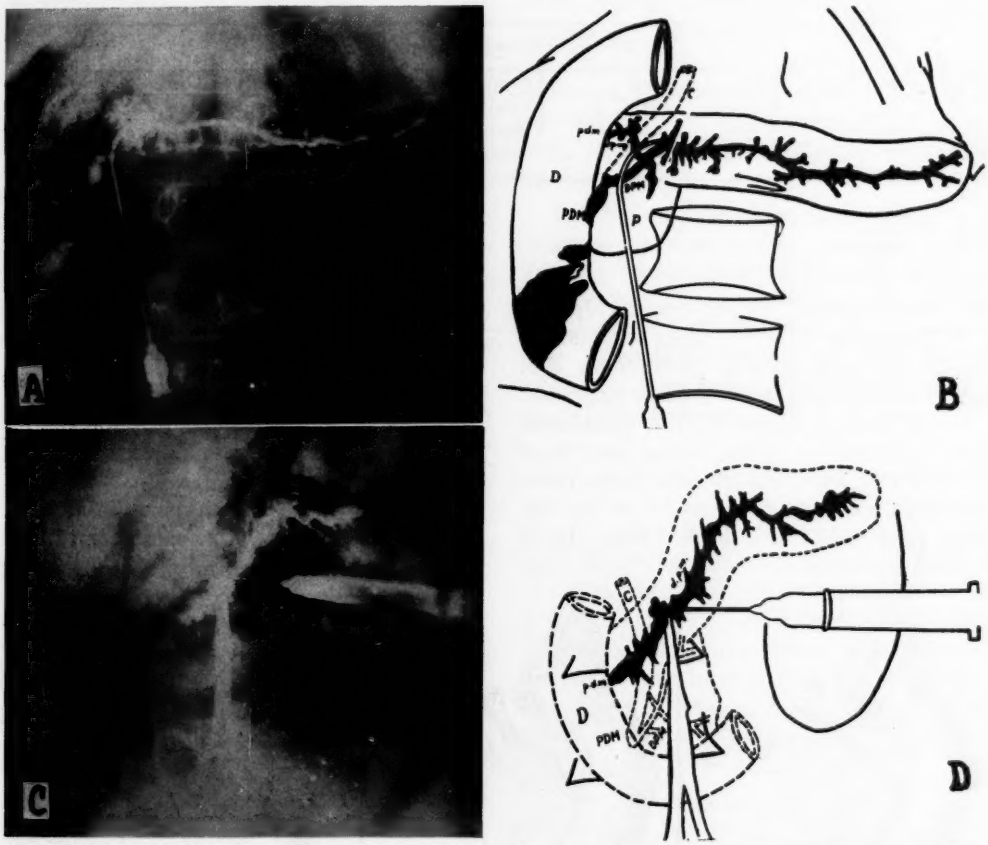

Fig. 2.—*A*, pancreogram with 3 ml. of uroselectan B injected at the level of the pancreatic neck (A. R., a 59-year-old white Brazilian woman). *B*, diagram of ducts shown in *A*, after dissection, with pancreas *in situ*. *C*, roentgenogram of the pancreatic ducts after injection of uroselectan B (S. F., a white Brazilian man aged 50). *D*, diagram of ducts shown in *C*, after dissection. Note variety of pancreatic ducts, in which the minor pancreatic duct (ventral), responsible for the drainage of the major portion of the pancreas, is the main duct. The independent major pancreatic duct drained part of the posterior portion of the pancreatic head and was confluent with the choledochus in forming the major duodenal papilla.

Data on Experimental Study

		Posterior Aspect			
Superior border	White	Male 24	Female 8	32% (S* = 4,66)	36% (S = 3,39)
	Negro	Male 23	Female 17	40% (S = 4,89)	Fig. 1 B
Equidistant from	White	Male 32	Female 9	41% (S = 4,91)	43,5% (S = 3,50)
borders	Negro	Male 28	Female 18	46% (S = 4,98)	Fig. 1 A
Inferior border	White	Male 1	Female 2	3% (S = 1,70)	4% (S = 1,92)
	Negro	Male 2	Female 3	5% (S = 2,17)	Fig. 1 D
		Anterior Aspect			
Superior border					
Equidistant from	White	Male 3	Female 0	3% (S = 1,70)	1,5% (S = 0,85)
borders	Negro	Male 0	Female 0	——	Fig. 1 E
Inferior border					
		Equidistant from the Borders			
Superior border	White	Male 2	Female 2	2% (S = 1,40)	1% (S = 0,70)
	Negro	Male 0	Female 0	——	Fig. 1 F
Equidistant from	White	Male 13	Female 6	19% (S = 3,92)	14% (S = 2,45)
borders	Negro	Male 6	Female 3	9% (S = 2,86)	C Fig. 1 C

* $S = \sqrt{\frac{p.q.}{N}}$

the "pars flacida" of the small epiploön.

3. An incision 1.5 cm. long, perpendicular to the axis, of the peritoneum that covers the anterior aspect of the pancreas.

4. Delicate incision of the pancreatic tissue at the level of the medial portion of the anterior aspect of the pancreatic neck, with a thin scalpel, so as not to section the duct (Fig. 3*A*); at this site there is 59 per cent probability of finding it immediately. When this was not possible, a dissection was made in the direction of the cranial border (37 per cent of the cases).

5. Dissection of a small portion of the major pancreatic duct, sufficient to allow puncture (Fig. 3*B*).

6. Puncture with a thin needle and injection of 3 to 5 ml. of contrast medium,

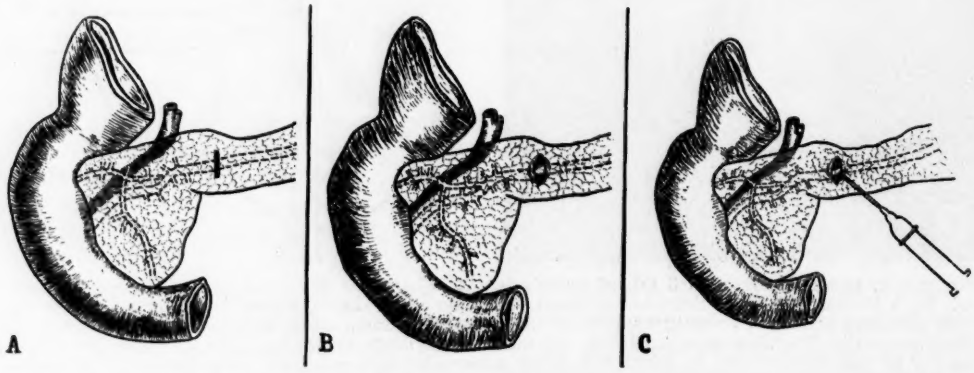

Fig. 3.—*A*, anterior view of the duodenopancreas. The level of incision on the pancreatic neck is shown in solid black. *B*, dissection of a small segment of the major pancreatic duct. *C*, puncture with a thin needle; injection of 3 to 5 ml. of contrast medium.

sufficient to fill the pancreatic tree. Preference was given to an aqueous medium, owing to the easy diffusion by which it penetrates into the small branches. (Fig. 3*C*).

7. Roentgenographic studies immediately after the injection to avoid distortion of images. It is obvious that in the living subject interpretation will depend upon the patient's clinical status and other data.

Sequence of operation will depend upon the conduct followed in each case:

1. Suture of peritoneum covering the pancreas; closure of the retrocavity of the epiploöns, and suture of the abdominal wall.

2. Drainage of the major pancreatic duct by means of a polyethylene tube to study the pancreas during the postoperative period. The drain passes the opening of the great epiploön and reaches the skin through the same incision or through an opposite opening.

In both instances drainage of the peritoneal cavity, as well as of the retrocavity of the epiploöns, is necessary. A Penrose drain is used to prevent the collection of pancreatic juice, which otherwise might leak through the puncture orifice.

Advantages of the Transpancreatic Approach. — The proposed transpancreatic approach, although not as yet attempted on the living subject, has the following possible advantages:

1. Section of pancreatic tissue is made in a zone where there is only one duct (of variable caliber), which is object of dissection; the other sectioned channels are small.

2. No vital organs are harmed, except the pancreatic tissue and a small portion of the peritoneum, easily sutured.

3. An operative and a postoperative pancreographic study is possible, if a polyethylene tube is left in the duct's lumen.

4. Drainage of the pancreatic duct is permanent, and purer pancreatic juice is obtained.

5. Roentgen study is possible when the main duct is independent from the accessory duct, reaching the minor and not the major papilla, which by other methods would be impossible (Fig. 2*C* and *D*).

6. It enables one to explain pathologic processes located in the major duodenal papilla or near it.

7. Operative and postoperative manometric studies of the pancreatic component of the sphincteric system of Vater's papilla can be made (suggested to Leger by Caroli).

8. Opening of the duodenum is unnecessary.

9. Certain difficulties presented by retrograde catheterization, such as search for the major duodenal papilla or penetration into the choledochus, are avoided; no trauma to this papilla, site of a complex functional mechanism, is involved, especially if catheterization is done during a sphincteric spasm.

SUMMARY

An approach to the major pancreatic duct (Wirsüng's duct) is proposed. Results of anatomic dissections and pancreatographic studies of cadavers are presented.

The technic is described. It is characterized by exposure of the major pancreatic duct (Wirsüng's duct) at the level of the neck of the pancreas.

ZUSAMMENFASSUNG

Es wird ein Zugangsweg zum Wirsüngschen Bauchspeicheldrüsengang in Vorschlag gebracht. Ergebnisse anatomischer Präparierungen und pankreatographischer Untersuchungen an der Leiche werden dargestellt.

Die Technik wird beschrieben. Sie ist gekennzeichnet durch die Freilegung des grossen Wirsüngschen Pankreasganges auf der Höhe des Halses der Bauchspeicheldrüse.

RESUMEN

Se propone una vía para el conducto pancreático mayor (conducto de Wirsüng). Se presentan los resultados de disecciones anatómicas y de estudios pancreatográficos en cadáveres.

Se describe la técnica. Se encuentra caracterizada por la exposición del conducto pancreático mayor (conducto de Wirsüng) al nivel del cuello del páncreas.

RIASSUNTO

Viene descritta una nuova via di accesso al dotto di Wirsüng; essa è stata studiata mediante dissezioni anatomiche e pancreatografie sul cadavere. Il dotto viene raggiunto a livello del collo del pancreas.

RÉSUMÉ

Une exposition du conduit majeur pancréatique (conduit de Wirsüng) est proposée. Les resultats des sections anatomiques et des études pancréatographiques à des cadavres sont présentées.

La technique est décrite. Elle est characterisée par l'exposition du conduit majeur pancréatique (conduit de Wirsüng) à la hauteur du col du pancreas.

SUMÁRIO

É proposta uma via de acesso ao ducto pancreático principal (ducto de Wirsüng), sendo apresentados os resultados das dissecções anatômicas e estudos pancreatográficos em cadáveres.

É descrita a técnica, que se caracteriza pela exposição do ducto pancreático principal (ducto de Wirsüng) ao nível do colo do pâncreas.

Education is the leading human souls to what is best, and making what is best out them; and these two objects are always attainable together, and by the same means; the training which makes men happiest in themselves also makes them most serviceable to others.

—*Ruskin*

The power of ideas is incalculable. We see no power in a drop of water. But let it get into a crack in the rock and be turned into ice, and it splits the rock; turned into steam, it drives the pistons of the most powerful engines. Something has happened to it which makes active and effective the power that is latent in it.

—*Schweitzer*

The Therapeutic Problem of Congenital Atresia of the Bile Ducts

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A VERY serious problem in infantile surgery is presented by atresia of the bile ducts. A really interesting chapter on the subject is to be found in the admirable treatise of pediatric surgery recently published by Gross:[1] It refers to 146 cases of various types of atresia operated on at the Boston Children's Hospital. Only in 27 of the cases were conditions presumably susceptible of a happy solution. Success could only be reached when the state of the extrahepatic bile ducts was such as to enable the surgeon to adopt one of the proceedings of anastomosis capable of establishing a functioning communication between the biliary system and the digestive tube.

Gross[1] affirmed that only 18 per cent of these patients could be safely declared "operable." The conclusion drawn by the great surgeon on the future destiny of the remaining 82 per cent was really discouraging. The conclusion was a negative one and based on the unsuccessful attempts made on 5 cases where the only possible intervention to have recourse to was hepatodigestive anastomosis.

In such cases, after a large part of the left lobe of the liver had been removed, the superficial hepatic section was anastomized to the stomach in order to insure the flowing of the bile from some small intrahepatic ducts. This never happened. Nor was it possible to find an intrahepatic duct larger than a pinpoint; anastomosis was therefore evidently impossible, even between an intrahepatic bile duct and the jejunum, as Longmire had advised for adults.

Longmire himself was unsuccessful with his procedure in 3 cases of total atresia of the extrahepatic biliary system. In the 2 cases in which he succeeded in effecting anastomosis of the jejunum with a small duct or with connective tissue containing canaliculi, he obtained between the biliary and the gastrointestinal tract, temporary intercommunication with "green" feces, for a maximum of seven days, without discovering, after successive surgical interventions, how to keep the intercommunication open.

Other surgeons too have obtained bile flow for some days before the final outcome of the intervention through colangioenterostomy by various technics. Such a flow was prolonged for some weeks in the Dahl-Iversen and Gormsen case by an external derivation, through a hepatostomy, by making an opening in the very center of the hepatic tissue. The bile, however, always remained scarce even after the breach had been repeatedly enlarged and deepened. The results are evidently rather discouraging.

I performed a hepatodigiunostomy in a case of complete atresia of the extrahepatic bile ducts. The case was illustrated in a paper published by my surgical assistant, Dr. Righini, and contains more details of the case. A continuous flowing of the bile into the intestine was observed in my patient, who died twenty-five days

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later of an intercurrent disease. The proportion of the flowing was sufficient to give the feces an intense green color and to provoke typical green diarrheic stools.

I do not mean to attach excessive importance to these results. I should, however, say that they are interesting, as they at least demonstrate that the reduced biliary intrahepatic system can be utilized for the flowing of the bile and that such a flow can last for a long time in sufficient proportions. These observations had never been made before.

Differences in the various attempts made might be ascribed, first of all, to the different states of the various intrahepatic bile ducts. It is a known fact that in a liver of markedly abnormal structure in the abscence of ducts, the canalicular biliary intrahepatic system may be developed differently in various patients: it may also be totally absent owing to complete intrahepatic atresia. For this reason Dahl-Iversen and Gormsen recommend biopsy, with an extempore examination of the hepatic parenchyma, before proceeding any further in execution of the anastomosis. It is evident that only when numerous canaliculi exist is there an element on which to rely and by which to be encouraged to carry on with the operation.

The case in which I operated the structure of the parenchyma was far from normal. No bile duct existed, but numerous canaliculi were revealed by biopsy at the moment of the operation; they were secreting bile and were observed to be open and apparently functioning well even after twenty-five days, as ascertained by macroscopic examination. This is contrary to what other surgeons have observed only a few days after the intervention; i.e., the cessation of all communication with the intestinal lumen. Microscopic examination in my case later revealed modifications tending to normalize the parenchymal structure in the area surrounding the "niche" of derivation.

Also, in the aforementioned case of Dahl-Iversen and Gormsen, biopsy revealed the presence of numerous biliary canaliculi: microphotographically they showed remarkable resemblance to those in my case, which were illustrated in Dr. Righini's paper. Also, in the case of these two surgeons the flowing of the bile lasted for a long period—a phenomenon denoting a remarkable tendency toward functioning of the anastomosis. The amount of bile secreted was, however, always insufficient.

This different behavior of the bile flow in the 2 cases presenting similar favorable conditions suggests the idea that for the success of the operation not only the state of the intrahepatic bile ducts but also technic used is important.

In the absence of real bile ducts, one or a few of which could supply a sufficient quantity of bile, one should endeavor, first, to secure the use of small canaliculi and, second, to attempt the maintenance of their function. It is therefore necessary tto obtain an ample excised surface and to do one's utmost to prevent any kind of stimulus for exerting any action on it. Stimuli might favor the rapid progress of granulation, endangering the perviousness of the canaliculi.

The first object is obtained by excavating a "niche" into the liver with a bistoury, through removal of a block of parenchyma (useful also for biopsy). I effected it by starting from the inferior facies of the right lobe, not very far from its inferior margin. The diameter of the cut area was 1 cm. and its depth 1.5 cm. This modest diameter enables the surgeon easily to anastomize the margins of the breach thus produced to a small breach of jejunal loop. This way of proceeding, by enabling one to penetrate into the very depth of the hepatic mass, insures the opening up of many canaliculi coming from all directions of the surgically treated lobe. This can-

not be obtained by preparing an even surface of modest size, while an ample surface is not easily anastomized to the intestine. But — and this is very important — the aforedescribed proceeding proves to be contradictory to the second object desired, because after the anastomosis the "niche" reaches directly into the internal limit of the intestinal lumen and comes into direct contact with the luminal contents. The "niche" is therefore an obvious disadvantage as far as its being shielded from the stimuli is concerned. Concerning the harmful effects of the stimuli thermocauterization and electrocoagulation, in my opinion, are to be discarded as well as tubular and gauze drainage (cf. cases of opening by hepatostomy), as the former are apt to injure the canaliculi, and closing them first with eschar and later with granulations, whose propagation is favored by the drainage.

On the basis of these considerations, the problem of atresia of the bile ducts can be summarized as follows:

Hepatoenteric anastomosis seems to be the only means one can rely upon when the condition of the extrahepatic bile ducts do not enable one to effect a communication between that part of them which can remain pervious and the intestinal lumen.

The possibility of a successful operation is viewed with great pessimism nowadays. The reason lies in the fact that the results of the few attempts made up to now have been generally discouraging: they were undertaken, moreover, with different and sometimes questionable technics. Such attempts, however, are insufficient to give a definitive answer to the problem.

Any attempt is naturally useless *a priori* when there is complete atresia of the intrahepatic bile ducts. In the best possible conditions the surgeon is limited to numerous canaliculi with complete absence of ducts. In any event, exact information on the subject is still needed.

The possibility of provoking a flow of digestive bile is based on the presence of the canaliculi and on their development: the possibility has already been demonstrated, presumably when with favorable conditions of the intrahepatic bile ducts were present.

It is to be hoped that a convenient technic will enable surgeons to insure, in suitable cases, an easy and permanent bile flow.

Abnormal structure of the parenchyma accompany atresia of the intrahepatic bile ducts.

Nonsurgical patients with permanent icterus who have survived for years testify that there is "sufficient function" of the parenchyma. A long, exhaustive experience is still lacking. While the results of future experiments are awaited, it is still to be hoped that intervention will lead, at least in a few rare cases, to the solution of the problem.

As it is a question here of a form of atresia that can be corrected only by surgical intervention, a clinico-operative and anatomopathologic study of the patient is necessary. Little help is to be expected from experimental contributions, as the lesion is impossible to reproduce.

SUMMARY

Surgeons should be warned against the pessimism that prevails with regard to congenital atresia of the bile ducts. The problem is, perhaps, only apparently destined to remain unsolved. Only by uniting the efforts of many surgeons will it be possible to establish with certainty whether and in what measure the hepatodigestive anastomosis is capable of determining the biliary derivation to the digestive tube with permanent disappearance of the jaundice, and if the hepatic tissue conditions are sufficient or susceptible of recovery to such a degree as to constitute survival.

ZUSAMMENFASSUNG

Der Verfasser tritt gegen den Pessimismus auf, den man unter den Chirurgen findet, wenn es sich um die Behandlung des angeborenen Verschlusses der Gallenwege handelt. Vielleicht sieht es nur augenblicklich so aus, als ob das Problem zur Unlösbarkeit verdammt sei.

Es bedarf der vereinten Kräfte einer grossen Anzahl von Chirurgen, um zu einer klaren Erkenntnis zu kommen, ob und in welchem Masse die Anastomosierung zwischen der Leber und dem Verdauungskanal zu einer Ableitung der Galle in den Darm unter ständigem Ausbleiben von Gelbsucht führen kann, und ob der Zustand des Lebergewebes ausreicht, um zu einer mit dem Leben vereinbaren Erholung zu führen.

RIASSUNTO

Viene constatato l'attuale concorde scetticismo esistente fra i chirurghi sulla possibilità di agire nella atresia delle vie biliari quando mancano in quelle extraepatiche le condizioni per una loro anastomosi col tubo digerente.

Si ricorda che anche le vie biliari intraepatiche, se non sono completamente assenti, sono anormalie e che l'unico tentativo da farsi in quest'ultimo caso è l'anastomosi epato-digestiva.

Sulla scorta di un caso personale così operato, caso che ha mostrato la possibilità di ottenere buon deflusso biliare nell'intestino per un periodo di tempo non breve e, tenendo presenti le incertezze che ancora esistono in materia per la scarsa esperienza attuale, si raccomanda che, senza illusioni, ma anche senza assoluto pessimismo, si continui lo studio di questi casi, cercando di praticare l'intervento. Si potrà così stabilire se assolutamente tutti siano superiori alle risorse della chirurgia o se sia permesso sperare nell'eventualità, per quanto anche rara, di successo.

SUMÁRIO

Os cirurgiões devem ter o espírito prevenido contra o pessimismo que prevalece com relação à atresia congênita das vias biliares. O problema talvez esteja apenas aparentemente condenado a permanecer sem solução.

Apenas unindo-se os esforços de muitos cirurgiões será possível asetabelecer-se com certeza se a anastomose hepato-digestiva é capaz de determinar a derivação biliar para o tubo digestivo com desaparecimento permanente de icterícia e se as condições do tecido hepático são suficientes ou susceptíveis de recuperação a ponto de permitir a sobrevida.

RÉSUMÉ

Les chirurgiens seraient mis en garde contre le pessimisme qui prévaut quant à l'atrésie congénitale des canaux biliaires. Le problème n'est peut-être destiné à rester sans solution qu'en apparence.

Ce n'est que par l'union des efforts de nombreux chirurgiens qu'il sera possible d'établir avec certitude si oui, et dans quelle mesure, l'anastomose hépatodigestive est capable d'assurer la dérivation biliaire au tube digestif avec disparition permanente de la jaunisse, et si l'état du tissu hépatique est suffisant, sinon susceptible de guérison au point de permettre la survie.

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Disability Evaluation

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THE medical expert's opinion is sought because of his knowledge of the human body. The wheels of progress have traveled through a long period of experience since the initiation of the first compensation laws. Their general pattern has remained essentially the same, even though profound economic changes and unparalleled industrial developments have encircled the world.

The medical profession in general has remained indisposed toward improved relations with trial procedures, so that expert testimony has continued in the rut of the common practice of providing testimony of the "claimant's doctor" versus the "defendant's doctor." The problems of rating and evaluating permanent disability remain entangled in the meshes of unscientific routine procedure. Statutory awards for permanent disabilities continue to serve more as conveniences for monetary settlements than as economic cushions to soften the misfortune of the injured claimant and his responsible employer. Scientific research is greatly necessary, and the teaching fundamentals of rating and evaluating disability are needed in the curriculums of medical schools.

Preemployment Examinations. — First of all, something should be done to establish general interest in physical fitness in its relation to job placement. In times of war the nation requires physical fitness of the soldier, but only the larger industrial firms insist on preemployment examinations, and in many instances this is merely a matter of printed forms hastily filled out. Roentgenograms are sometimes required, but seldom is the employee tested for his mental reactions or given consideration for his size and age. When physical defects are found the applicant is rejected. Then what? Fortunately there are still jobs open that do not require preemployment examinations. Yet, here the difficulty of disability rating begins. There is no established norm. The injury may be mild, yet preexisting physical deficiencies of which the worker is totally unaware may be so aggravated as to eliminate him completely from the labor market. How difficult would it be to establish a record of physical fitness for labor on a national basis, with reliable classifications that would relieve the employer of at least some of the hazards of employing physically handicapped persons?

Treatment.—The doctors of today have become accustomed to forms and reports. More and more doctors' bills are being paid by a third party. This third party must have its claim files in order if they are to operate efficiently. A serious injury must be evaluated in respect to duration of temporary disability and the probable period required for maximum healing. Permanent disability is to be, at least approximately, estimated.

Treatment, from the start, must include anticipation of possible permanent disability. Preservation of function should pre-

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dominate all definitive surgery and medication. Ankylosis, atrophy and deformity should be prevented rather than left to the physical therapist later on. That is, rehabilitation should accompany active treatment; however, permanent disability should not be declared without full consideration of maximum restoration of function through rehabilitation and readjustment.

Examination and Report or Expert Testimony. — The emotional response of the human mind to injury is unpredictable. One of the greatest responsibilities in the treatment of an industrial patient is to be able to see through the immediate acute aspects of the injury and reasonably foretell the duration of the temporary disability and the extent of permanent disability. In examination of the healed injury for determination of the extent of disability, the ability to diagnose and weigh the subjective complaints with the physical observations requires not only extraordinary medical knowledge and experience but good judgment, tact and diplomacy. The tendency to exaggerate is a common experience. To judge the apparent inconsistencies of the symptoms and to weave the threads of reality into the diagnostic pattern requires patience and a special attitude toward this type of case.

Temporary Total Disability. — The period of temporary total disability should coincide with the treatment, or healing period, of an industrial injury. Unfortunately, the employee cannot always return to his job when his doctor says his injury has healed and he is able to start back to work. Two principal factors are often overlooked: 1. The necessity of rehabilitation and readjustment. 2. The willingness of the employee to cooperate. The industrial employee is often dismissed by his doctor only to find that he still has stiffness, tenderness or pain that will not permit him to do his regular job with the efficiency expected of him. His employer may tell him he has no light work—the worker cannot do his regular job; there is no place for him. Psychoneurosis and mental depression then are given opportunity to develop. The injured person is thus caught in a settlement trap. He must meet current expenses. He may submit to early settlement because of worry and anxiety. His rehabilitation is left to his ability to find work that is suitable to his disabled physical status.

Permanent Partial Disability. — The medical evaluation of disability is not so complicated when there is definite, demonstrable damage to the injured parts of the body. The adjudication of such claims are usually clear of bitter contention. Wide variations in opinion arise chiefly in cases in which the complaints are out of proportion to the objective evidence of physical alterations due to injury.

Doctors who examine and testify chiefly for claimant and give unusually high ratings for disability are sometimes accused of having mercenary, or unscrupulous motives. Their experience in life, as well as their medical judgment, may have caused them to acquire a more sympathetic attitude and a deeper regard for the misfortunes of man. On the contrary, the doctor who is frequently engaged by the employer is accustomed to being accused of being the "company doctor." He may see little of the human effect of the disability and he likely believes that if physical examination gives negative results there is no permanent disability.

Medical opinion is presented to the court in order to accumulate evidence upon which the loss of wage earning capacity may be adjudicated. The evidence of greatest importance seems to be the percentage of permanent disability estimated by the doctor. The higher opinion of the claimant's doctor and the lower opinion of the defendant's doctor are often averaged.

Under fixed rules of procedure, little weight is given to the method of medical diagnosis and clinical reasoning upon which the doctor bases his opinion. Elimination of the charlatan in the general practice of medicine has been accomplished gradually by raising the standards of medical education so that the public is quick to recognize competent or incompetent medical advice; but the industrial court still must listen to expert testimony that is nothing more than an auction bid on the value of a man's misfortune.

Necessity of a Formula for Evaluating Permanent-Partial Disability.—The maximum assessment for disability is the amount specified by law for total-permanent disability. Permanent-partial disability is a percentage of the total, but in only a few instances are permanent-partial disabilities included in the schedule provided by law. It falls to the lot of the doctor, as a medical witness, to determine the extent of physical damage to the body, and the extent to which the injury will interfere with normal function in the performance of ordinary manual labor. The conscientious doctor will want a scientific basis for his opinion. To make a systematic investigation there must be a method of reconciling the losses of the injured parts with the remaining values of the uninjured parts. In order to test these values, some analytic formulae should be used to bring out the ratio of the remaining values to the existing losses. The final conclusion should be the percentage of permanent-partial disability. Tests of this order require considerable mathematical concentration, which is not very fascinating to the average medical mind. Nevertheless, it is a great satisfaction to have a sound basis upon which to base a medical opinion that involves monetary awards. Disability is the result of many factors involving the effects of injury and disease on the human organism. All of the disabling factors must be analyzed and weighed in the mind of the examiner in order to arrive at an evaluation of the disability loss as compared to the normal state still available to the worker. The disabling factors are related in an affiliative, rather than a cumulative, proportion. For this reason, an average of percentile loss attributed to all the disabling factors observed on examination will give a fair estimate of the per cent of disability, provided a thorough survey is made, so that each and every disabling factor may be given a percentage of loss, as compared to normal. A man with severe anatomic damage and little loss of function should not be penalized with a low rate of disability because he minimizes his pain and insists on working, nor should one with extreme clinical manifestations and little or no anatomic change to confirm his disability be overrewarded.

Percentile Rule of Severity. — The degree of severity is often difficult to express in percentages. The correlation of descriptive terms which express the degree of severity, graded to a corresponding percentage, can be very helpful in arriving at a definite conclusion if applied to each factor contributing to the disability. The severity of loss may be graded to the following percentages:

Slight	Not over	5%
Mild	Not over	10%
Very moderate	Not over	20%
Moderate	Not over	30%
Mildly severe	Not over	40%
Moderately severe	Not over	50%
Very severe	Not over	60%
Extremely severe	Not over	70%
Profoundly severe	Not over	90%
Total	Not over	100%

I have previously outlined and stressed the importance of a basic system of evaluating disability.* Of late, a more comprehensive formula has been used.** This

*McBride, E. D.: Disability Evaluation. Philadelphia: J. B. Lippincott Co., 5th ed.

**McBride, E. D.: Instructional Course Lectures, Academy of Orthopedic Surgery, 1955.

MEDICAL ANALYSIS OF PERMANENT PARTIAL DISABILITY

Date_____

PATIENT'S NAME _____ ADDRESS _____

CHECK PART OR PARTS OF BODY DISABLED:

Whole Body	Fingers (1-2-3-4)	Thumb	Hand	Arm	Leg	Foot	Toe

	DUE TO INJURY	DUE TO PRE-EXISTING INJURY OR DISEASE
THE PARTIAL TEMPORARY DISABILITY IN THIS CASE IS:	_____ Per Cent	_____ Per Cent
THE PERMANENT PARTIAL DISABILITY IN THIS CASE IS:	_____ Per Cent	_____ Per Cent

PRESENT STATUS OF INDIVIDUAL

Maximum improvement reached?	Yes	No
Further Treatment indicated?	Yes	No

Condition Stationary?	Yes	No
Rehabilitation indicated?	Yes	No

This percent of disability is based on thorough physical examination in which the following unit factors of disability have been fully analyzed and averaged. Uninvolved factors remain to the normal advantage of the individual.

DISABILITY DIRECTED TOWARD		
1. ORDINARY MANUAL LABOR	Yes	No
2. SPECIFIED OCCUPATION	Yes	No

TWO PROPORTIONAL COMPONENTS OF DISABILITY

1. FUNCTIONAL DEFICIENCY 7 Units 100 Percent each	Rating	75 Percent
2. PHYSICAL DISORDERS 5 Units 100 Percent each	Rating	25 Percent
	Total Rating	100 Percent

FORMULA FOR RATING DISABILITY:
Insert total percentages of unit losses

$$\frac{\text{Functional Deficiency}\ \%}{700} \times 75 + \frac{\text{Physical Disorders}\ \%}{500} \times 25 = \_\_\_\_\_\ \%\ \text{Disability}$$

THE PERCENTAGE RULE OF SEVERITY

Apply this rule to each factor of all the units to estimate percent of severity.

0	5	10	20	30	40	50	60	70	80	90	100
Slight	Mild	Very Moderate	Moderate	Mildly Severe	Moderate Severe	Very Severe	Extremely Severe	Profound Severity		Total	

Apply rule of severity to evaluate each factor loss
FUNCTIONAL DEFICIENCY UNIT VALUE % 700 PERCENT.

	Normal value each factor 100% Compute Loss each Factor
1. QUICKNESS OF ACTION	
2. COORDINATION, SKILL	
3. STRENGTH	
4. SECURITY, CONFIDENCE	
5. ENDURANCE	
6. SAFETY, UNDUE RISK	
7. PRESTIGE OF PHYSIQUE For employment	

Grand total Component Functional Deficiency_____ Percent

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Southwestern Stationery and Bank Supply, Oklahoma City

PHYSICAL DISORDERS UNIT TOTAL VALUE 500 PERCENT

Evaluate percent loss each unit deviates from 100% normal. Total loss for each entire unit cannot be over 100 percent. Transfer grand total percentage loss to the formula on the opposite page to obtain percent of disability. Write in unlisted items. If pathology is pre-existing, so designate.

Apply rule of severity to evaluate percent loss of each unit

ANATOMICAL MASS DAMAGE UNIT

(Objective findings only)
Percent less than normal in this case _____ %

Check involved factors

- ☐ 1. BONE DEFORMITY
  - ☐ Excess callous
  - ☐ Shortening
  - ☐ Mal-union
  - ☐ Non-union
  - ☐ Angulation
  - ☐ Osteomyelitis
- ☐ 2. SPINE DEFORMITIES:
  - ☐ Herniated disk
  - ☐ Joint asymmetry
  - ☐ Anomalies
  - ☐ Scoliosis
  - ☐ Fracture, Deformities
  - ☐ Disease: Arthritis
- ☐ 3. JOINT PATHOLOGY:
  - ☐ Altered axis
  - ☐ Articular destruction
  - ☐ Ligamentous changes
  - ☐ Disease: Arthritis
  - ☐ Dislocation
- ☐ 4. MUSCLE DEFICIENCIES
  - ☐ Altered mechanics
  - ☐ Rupture
  - ☐ Contractures
- ☐ 5. EYE INJURY:
  - ☐ Puncture
  - ☐ Enucleation
  - ☐ Scar
- ☐ 6. EAR INJURY:
  - ☐ Drum
  - ☐ Osicles
  - ☐ Mastoid
- ☐ 7. SKULL:
  - ☐ Scalp, face
  - ☐ Depression
  - ☐ Osteomyelitis
- ☐ 8. CHEST:
  - ☐ Ribs
  - ☐ Lungs
  - ☐ Heart
- ☐ 9. BRAIN, CORD, NERVES:
  - ☐ Hermorrhage
  - ☐ Maceration
  - ☐ Meninges
  - ☐ Myelitis
  - ☐ Compression
  - ☐ Severance
  - ☐ Neuroma
  - ☐ Degeneration
- ☐ 10. BLOOD VESSELS:
  - ☐ Severance
  - ☐ Varicosity, Phlebitis
  - ☐ Aneurysm
  - ☐ Thombus, Embolus
  - ☐ Arteriosclerosis
- ☐ 11. BURSA, SYNOVIA:
  - ☐ Disease
  - ☐ Adhesions
- ☐ 12. VITAL ORGANS:
  - ☐ Contusion
  - ☐ Lacerations
  - ☐ Disease
- ☐ 13. SYSTEMIC DISEASE: Concurrent or Preexisting
  - ☐ Hypertension
  - ☐ Arthritis
  - ☐ Other disease
- ☐ 14. SKIN, FASCIA:
  - ☐ Loss of tissue
  - ☐ Scars
  - ☐ Contractures
  - ☐ Eruptions
  - ☐ Other Factors
- ☐ 15. GENITO—URINARY:
  - ☐ Bladder
  - ☐ Ureters
  - ☐ Kidneys
- ☐ 16. OTHER FACTORS:

JOBS RESTORATION UNIT

(Restrictions of Physical requirements)
Percent less than normal in this case _____ %

Check involved factors

- ☐ 1. LIFTING:
  - ☐ Heavy
  - ☐ Light
- ☐ 2. PULLING:
- ☐ 3. PUSHING:
- ☐ 4. REACHING, overhead
- ☐ 5. GRIPPING:
  - ☐ Finger dexterity
  - ☐ Fist power
  - ☐ Holding
- ☐ 6. WALKING:
- ☐ 7. RUNNING:
- ☐ 8. LONG STANDING:
- ☐ 9. CRAWLING:
- ☐ 10. KNEELING:
- ☐ 11. STOOPING:
- ☐ 12. BENDING:
- ☐ 13. CLIMBING:
- ☐ 14. THROWING:
- ☐ 15. BALANCING:
- ☐ 16. VISION:
  - ☐ Efficiency
  - ☐ Color
- ☐ 17. HEARING:
- ☐ 18. QUICK THINKING:
- ☐ 19. SPECIAL TALENTS:
- ☐ 20. OTHER FACTORS:

RESTRICTIONS WORKING CONDITIONS UNIT

(Environmental factors no longer can be tolerated)
Percent less than normal in this case _____ %

Check involved factors

- ☐ 1. OUTSIDE
- ☐ 2. INSIDE
- ☐ 3. HOT
- ☐ 4. COLD
- ☐ 5. SUDDEN CHANGE
- ☐ 6. DAMPNESS
- ☐ 7. DUST
- ☐ 8. RADIANT ENERGY
- ☐ 9. ELECTRICAL HAZARDS
- ☐ 10. GREASE
- ☐ 11. WATER
- ☐ 12. SOLVENTS
- ☐ 13. DARKNESS
- ☐ 14. SLIPPERY FOOTINGS
- ☐ 15. MACHINERY HAZARDS
- ☐ 16. IRREGULAR HOURS
- ☐ 17. RIDING, OR DRIVING STRAIN
- ☐ 18. OTHER FACTORS

CLINICAL MANIFESTATIONS UNIT

Percent less than normal in this case _____ %

Check involved factors

- ☐ 1. PAIN, TENDERNESS
- ☐ 2. MUSCLE SPASM
- ☐ 3. LOSS OF MOTION
- ☐ 4. SWELLING, INDURATION
- ☐ 5. INFLAMMATION, TEMP.
- ☐ 6. PARALYSIS
- ☐ 7. REFLEX LOSS
- ☐ 8. NUMBNESS
- ☐ 9. HYPER-SENSITIVE
- ☐ 10. CONTRACTURE
- ☐ 11. ATROPHY, TROPHIC
- ☐ 12. ISCHEMIA
- ☐ 13. GANGRENE
- ☐ 14. LIMP, WALKING AID
- ☐ 15. SYNOVITIS
- ☐ 16. CREPITUS
- ☐ 17. SUPPURATION
- ☐ 18. DIZZINESS
- ☐ 19. ATAXIA
- ☐ 20. ECCHYMOSIS
- ☐ 21. FATIGUE
- ☐ 22. PSYCHONEUROSIS
- ☐ 23. EXAGGERATION
- ☐ 24. EYE SYMPTOMS
- ☐ 25. EAR SYMPTOMS
- ☐ 26. SYSTEMIC SYMPTOMS
- ☐ 27. HEART AND BLOOD VESSEL CHANGE
- ☐ 28. BONE DISEASE
- ☐ 29. OTHER FACTORS

REACTIONARY INTERFERENCES UNIT

(Intangible factors altering future endeavors)
Percent less than normal in this case _____ %

Check involved factors

- ☐ 1. REHABILITATION
- ☐ 2. LIMITED OPPORTUNITIES
- ☐ 3. ECONOMIC HANDICAPS
- ☐ 4. LIMITED EDUCATIONAL BACKGROUND
- ☐ 5. ADVERSE INCENTIVE TO WORK
- ☐ 6. ADVERSE SOCIAL RELATIONS
- ☐ 7. UNFAVORABLE LABOR SITUATIONS
- ☐ 8. AGE LIMITATIONS
- ☐ 9. UNPREDICTABLE EXACERBATIONS OF PAIN OR SYMPTOMS
- ☐ 10. OTHER BODY IMPAIRMENTS OR DISEASE
- ☐ 11. OTHER FACTORS

Grand total of above five Physical Disorder Units _____ Percent

TRANSFER TOTAL TO FORMULA ON OPPOSITE PAGE

includes not only the evaluation of functional depreciation but a proportional consideration of the material physical damage and its effect on the future endeavor of the patient to work. Briefly, this formula of analysis is as follows:

Disability is divided into two principal components: (1) functional deficiency, and (2) physical disorders.

The functional component is considered of greater importance, or weight, and is given a proportional value of 75 per cent, while the component of physical disorders is rated at 25 per cent. Function is divided into seven units, each having a value of 100 per cent normal, or a total of 700. The physical disorders component is divided into five units, each having a 100 per cent normal value, or a total of 500. The formula then is:

$$\frac{\text{Functional deficiency}}{700} \quad \% \times 75 +$$

$$\frac{\text{physical disorders}}{500} \quad \% \times 25 = \_\_\% \text{ disability.}$$

The Units of Functional Deficiency are as Follows:

1. Quickness of action	Normal 100%	Loss	%
2. Coordination and skill	Normal 100%	Loss	%
3. Strength	Normal 100%	Loss	%
4. Security; confidence	Normal 100%	Loss	%
5. Endurance	Normal 100%	Loss	%
6. Safety, or, risk	Normal 100%	Loss	%
7. Prestige of physique of employment	Normal 100%	Loss	%
Total normal	700	Loss	%

These seven units in the breakdown of function are, of course, closely related in their meaning, but individual consideration affords a sound basis of reasoning rather than mere guessing at the degree of loss of function. The result of the calculation of loss is an average that will be not far from what is right.

Loss of function must be rated independently on the efficiency with which the disabled person can perform the useful actions of work, notwithstanding the effects of the injury that has caused depreciation from the normal state. However, when the percentile loss of function is determined it must be correlated with the physical damage and the factors that limit job restoration.

The Units of Physical Disorders Component are as Follows:

1. Anatomic mass damage	Normal 100%	Loss	%
2. Clinical manifestations	Normal 100%	Loss	%
3. Restrictions of physical requirements	Normal 100%	Loss	%
4. Restrictions of working conditions	Normal 100%	Loss	%
5. Reactionary interferences	Normal 100%	Loss	%

The physical disorders component might be termed the "pain and suffering" unit. It accounts for the material damage, the pain and the physical limitations toward job restoration. It provides an opportunity to analyze the percentile depreciation of the physical state resulting from material damage to the body tissues and their effect on mind and body at work.

Anatomic Mass Damage.—The anatomic mass damage unit includes the objective abnormal changes noted on examination. There are as many variations in body response to injury as there are systemic reactions to physical influences. The extent of bone deformity, such as shortening, malunion, excess callus and the resulting mechanical alterations must be considered. This unit of factors is the basic source of disability. The extent of anatomic mass damage is revealed through a careful diagnostic examination that elicits the facts concerning physical changes from the normal. It requires not only a knowledge of the human anatomy but at least, some knowledge of geometry, physics and body mechanics. For example: a fractured bone shaft not only changes the length, contour and form of a bone but alters the mechanics of the structures attached thereto. The adjacent joint axes

may be altered, the kinetic forces lessened, the columnar support weakened and the line of equilibrium disturbed. The extent to which these structures and tissues are involved in the injury is expressed in percentile loss of the unit.

Clinical Manifestations. — The clinical manifestations unit is for the purpose of analyzing and weighing all the subjective and objective symptoms. The intensity of the clinical symptoms is not always indicative of the magnitude of the anatomic damage. A tiny neuroma may be totally disabling. The clinical manifestations must be weighed carefully in respect to their reality. The disability may be exaggerated and greatly overemphasized by the patient, but his complaints cannot be totally discounted by the examiner. Exaggeration may present what seems to be a disabling factor when really it is a neurosis. Permanent clinical symptoms must be recognized and distinguished from the temporary symptoms, improvement of which is still to be expected. Thus, such manifestations as pain, muscle spasm, loss of motion, paralysis, contracture and atrophy must be given consideration as compared to the normal and to the percentile loss evaluated for the unit.

Restrictions of Physical Requirements. —The greater the opportunity for employment of the disabled person, the less severe his physical incapacity for work. The surgeon who treats industrial injuries must always keep in mind the importance of the injured structure to the job at which the person has been employed. A stiffened finger can be more disabling than an amputation. A joint ankylosed in an unfavorable angle may prove very costly to a man's ability to follow his regular vocation. It is the responsibility of the medical advisor to determine the specific physical tasks a man may accomplish after his injury. One with a stiff knee might not be able to crawl, kneel, climb a ladder, run, walk or stand. These disabling factors should each be given a percentile depreciation, representative of the unit.

Restrictions of Working Conditions.— This unit involves factors in which environmental influences may be prohibitive to the placement of the disabled person. Exposure to outside temperatures or weather changes, dust, grease, slippery footings, driving strain and many other factors may influence the state of disability. Each disabling factor must be weighed, for its importance and percentile loss, as compared to normal, is established for the unit.

Intangible Reactional Interferences.— There are many intangible factors, more or less indeterminable, in many cases of disability. In many instances, the reactional influences involving mental, social and economic impediments are most difficult to ascertain. Most disabled persons are willing and eager to rehabilitate themselves. Others must have assistance, which may not be forthcoming. It is not enough for a doctor to say that the disabled person is now "able to do light work." The employer is likely to report that he has no "light work" at his plant. The man must do it all, or none. A man can hardly keep his self-respect when he returns to work with a partially disabled back and is placed in a job in which he must refrain from heavy lifting when it is expected of him. In many instances security rights play a role in prohibiting reemployment. Every such factor is given consideration and a percentage of disability estimated for the unit.

Application to the Formula.—The sum of the percentage of loss in each of the seven functional deficiency units is obtained and divided by 700. The sum of the five units of physical restoration is divided by 500. The component of function is the fundamental indicator of the extent of disability. It is given a weighted value of 75 per cent of the extent of disability.

Therefore, the percentage of functional loss is multiplied by 75 per cent. In turn, the percentage loss from the physical disorders component is multiplied by 25 per cent. The sum of the percentile loss of the two components is the rating for the disability of the part of the body under examination.

For example: Suppose the injured person has been thoroughly examined and the disabling factors are rated in a percentage of loss as follows:

Functional Depreciation:

Quickness of action	20 per cent
Coordination	25 per cent
Strength	15 per cent
Security, confidence	10 per cent
Endurance	25 per cent
Safety, or risk	15 per cent
Prestige of physique	10 per cent
Total	120 per cent

Physical Disorders:

Anatomic mass damage	25 per cent
Clinical manifestations	30 per cent
Restrictions of physical requirements	25 per cent
Restrictions of working conditions	10 per cent
Reactional interferences	15 per cent
Total	105 per cent

Application of the formula to these losses would be as follows:

$$\frac{\text{Funtion } 120}{700} \times 75 + \frac{\text{Physical Disorders } 105}{500} \times$$

$$25 = 17.13\% \text{ disability.}$$

This formula is practical and easy to use. It gives the medical examiner confidence in his final opinion on the rating of disability, and the deductions have a substantial basis of reasoning that support his opinion in the face of criticism. It is true that the various factors considered are greatly duplicated in meaning and the deductions as to the percentages of loss are in the final analysis necessarily arbitrary; however, if one makes a systematic analysis and a complete investigation of all the functional and physical causes of the disability, the rating arrived at is an opinion worthy of scientific acceptance.

SUMMARY

The subject of disability evaluation is briefly presented as having problems that require scientific system of diagnostic deductions. A formula is presented which provides a methodical procedure in arriving at an opinion on the rating of disability, on the basis of the percentile depreciation of the body from normal.

ZUSAMMENFASSUNG

Es wird der Versuch gemacht zu zeigen, dass sich bie der Abschätzung der Arbeitsunfähigkeit mutmassliche Raterei in hohem Masses vermeiden lässt, wenn der Betroffene mit der gleichen Sorgfalt untersucht wird wie andere Menschen, die Gegenstand medizinischer Untersuchung sind. Es wird eine brauchbare Formel vorgeschlagen, die zur Klärung der bei der Abschätzung der Untauglichkeit in Frage kommenden Überlegungen beiträgt.

RIASSUNTO

Viene proposto un metodo per valutare l'incapacità lavorativa; questo metodo può riuscire assai utile, purchè applicato con la massima cura. Viene suggerita un'utile formula per classificare i vari gradi.

RÉSUMÉ

Une tentative a été faite de démonstrer que l'on peut, dans une large mesure, tirer des conjectures de "l'évaluation d'incapacité, si le sujet est étudié avec le même soin que les autres patients médicaux. Une formule utile est suggérée, pour clarifier la pensée au cours de l'évaluation d'une incapacité.

SUMARIO

É feita uma tentativa no sentido de demonstrar que as suposições podem em grande parte ser afastadas da "avaliação de incapacidade," desde que o paciente seja estudado tão completamente quanto outros pacientes. Sugere-se uma fórmula útil para auxiliar o raciocínio na avaliação da incapacidade.

SUMARIO

Laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths disclosed, and manners and opinions change with the change of circumstances, institutions must advance also, and keep pace with the times.

—*Jefferson*

Thoughtful men, once escaped from the blinding influences of traditional prejudice, will find in the lowly stock whence man has sprung the best evidence of the splendor of his capacities; and will discern in his long progress through the past a reasonable ground of faith in his attainment of the future.

—*Huxley*

Man, made of the dust of the world, does not forget his origin; and all that is yet inanimate will one day speak and reason. Unpublished nature will have its whole secret told.

—*Emerson*

Great historical movements are never begun for the attainment of remote and imperfectly comprehended ends. They demand something concrete to work for; they need clearly defined, particular aims.

—*Jaurés*

The history of civilization is the history of the slow and painful enfranchisement of the human race.

—*Ingersoll*

Spontaneous Rupture of the Small Bowel

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RUPTURE of a hollow or a solid abdominal viscus in association with external violence is not uncommon in the traumatic service of any large hospital. If a patient is brought to the hospital with signs and history of sudden acute peritonitis and shock, with no history or evidence of external trauma one always thinks of a ruptured viscus, and of course the commonest location for this is the first portion of the duodenum. In the absence of a perforated duodenum, spontaneous rupture of the remaining small bowel is extremely rare. In view of the fact that 4 such cases have been encountered in this 400-bed institution within the past few months, it behooves one to consider this condition a possibility in determining the cause of any sudden peritonitis.

The exact nature of the precipitating factor may be disease in the small bowel itself, a condition formerly occurring frequently in the presence of typhoid states and other ileitis of unknown cause. Perforation of the ileum in the absence of preexisting disease is the subject of this paper. In none of the 50 cases of spontaneous rupture of the small bowel reported in the literature has there been any evidence of any preexisting local pathologic condition, and the precipitating factor in the rupture was assumed to be sudden severe tension or strain on the abdominal muscles.

In all but 4 of the cases in the literature the rupture was associated with hernia, and injury to the bowel had occurred on the antimesenteric border near the hernial opening, where part of the bowel wall had been pinched. Weakening or rupture may also occur where the peritoneum has been attached to some area of another viscus or to the parietal peritoneum by adhesive bands, so that, with a sudden increase of intra-abdominal pressure, the bowel wall is injured and torn. In 2 of my cases there was evidence of inguinal hernia, and in 2 no such evidence existed, but in none was there evidence of the bowels having been adherent to any other peritoneal surface.

Review of Literature. — Simpson,[1] in 1938, described 25 cases of perforation of the gastrointestinal tract in infants, and Abt,[2] in his review of the literature, listed 60 cases in 1924. Thelander[3] and Russell,[4] in 1939 and 1940, accumulated 39 reports of spontaneous rupture of the intestine in newborn and older infants. Bullova and Brennan,[5] Boikan,[6] Dodd,[7] Fanconi,[8] Adamson and Hild,[9] Bronaugh and Lattimer,[10] Burgen,[11] Anderson[12] and DiLorenzo[13] have all reported spontaneous perforation of the small bowel both *in utero* and shortly after birth, due to inspissated and impacted meconium.

In adult life traumatic rupture of the small bowel follows external violence, but rarely is spontaneous rupture encountered. In 1937 Wilinsky and Kaufman[14] reported 43 cases, reviewing the possible etiologic and anatomic complications. Since then similar cases have been reported by Aird,[15] Robinson,[16] MacMillan,[71] Berman and Rosner[18] and Christopher,[19] who referred to the rupture as spontaneous or attributed it to sudden muscular effort. In practically all cases, however, the coexistence of some preexisting pathologic condition

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has been reported, usually hernia.

Incidence, Age and Sex.—Spontaneous or subparietal rupture of the small bowel is extremely rare. With the addition of the 4 cases here reported the reports in the literature number 54.

Although this type of rupture is most common in infancy, I am excluding infantile rupture and reporting only on the incidence in adult life. Adults engaged in strenuous labor are especially liable. Although one might assume that young adults are exposed to more sudden severe violent exercise than are elderly persons, spontaneous perforation of the intestine is very rare in youth. The average age of the patients reported by Wilinsky and Kaufman was 48 years. The average age of my 4 was considerably more advanced, namely 65.

Strangely enough, in all of the cases previously reported the patients were male, and usually the rupture was associated with stress and pre-existing intra-abdominal pathologic change. In my Case 4 the patient was a woman 71 years old. There was no hernia and no history of any strain on the abdominal musculature. At autopsy no pre-existent intra-abdominal pathologic change could be found.

Symptoms and Signs.—Usually there is a characteristic history, but my cases did not follow the usual pattern. Only 2 of the patients had demonstrable hernias, and none of them had undergone any sudden severe abdominal stress prior to rupture of the viscus. It is possible, of course, that a patient may unconsciously be exposed to sudden severe traumatizing contraction of the abdominal musculature without considering it significantly severe to report.

The patients have usually been in good health, and present themselves in sudden excruciating abdominal pain following a lifting episode. Nausea and vomiting are usually present, with some shock, the degree of which depends on the duration of the rupture. Many authors report that the patients continued their work for a few hours, until the peritoneal irritation and pain became so severe they were forced to seek help.

On examination the patient is usually doubled up and the skin cold, clammy and pale. The pulse is rather rapid and the blood pressure low. The temperature is usually normal. The abdomen in most instances is boardlike, and there may be increased tenderness in the quadrant overlying the ruptured bowel. A hernia is usually demonstrable. Roentgen examination of the abdomen should demonstrate some degree of pneumoperitoneum. The leukocyte count will probably be normal except in "delayed" cases.

Treatment.—The treatment, of course, is immediate operation, after adequate attention to the patient's shock and poor physical condition.

The perforation can usually be closed transversely in the bowel with interrupted sutures. Resection is rarely necessary.

The abdominal spillage must be aspirated, and the abdomen should be irrigated with saline solution. Antibiotics should be administered both intravenously and intramuscularly, and Levine suction should be instituted. Careful fluid, electrolyte and blood balancing will shorten convalescence.

Pathologic Picture.—In none of the reported cases has there been any evidence of preexisting structural changes in the bowel wall or any demonstrable pathologic state. The only abnormality observed, in most cases, is the existence of an abdominal hernia or adhesions, visceral and parietal. In rare cases no evidence of pathologic change has been elicited, and it is reasonable to assume that the weakness may be due to trophic changes in the bowel wall.

Fairchild expressed the opinion that in 1 of his cases trauma to the bowel may have precipitated an embolism, with gan-

grene and perforation. This was not verified and probably need not be given serious consideration in connection with most such injuries.

Mortality Rate. — It is not possible to present any figures on present-day mortality rates, the number of reported cases being very small since the advent of antibiotics and improved surgical methods. Wilensky and Kaufman[14] reported the mortality rate as 40 per cent for patients operated on within twelve hours, 71 per cent for those operated on within thirteen to twenty-four hours and 84 per cent for those operated on after twenty-five hours. Of course, the mortality rate for those not operated on is usually 100 per cent.

In recent years, since the use of antibiotics has become prevalent, this mortality figure is greatly reduced, and any patient whose rupture is operated on within a reasonable time of perforation should be saved. I should like to present the following 4 case reports of spontaneous rupture of the ileum, observed in this hospital within a period of about eighteen months. Two of them were in my service and 2 in separate surgical services of the staff.

REPORT OF CASES

CASE 1.—W. G. A 67-year-old man, was admitted to the hospital with severe generalized pain in the abdomen. He was reported to have been drinking beer and had had abdominal pain for about twelve hours. He had vomited several times and was doubled up in bed. There was no history of previous bowel trouble or of injury. He had lost no weight.

Physical examination gave essentially negative results except for the abdomen, which was thin, flat, symmetric, and extremely tender throughout. It was also very rigid, with marked rebound tenderness, not localized. There were no palpably enlarged organs. *The patient did have a right inguinal hernia.* The pulse rate was 140 per minute, and the blood pressure in millimeters of mercury was 100 systolic and 70 diastolic. The patient was in mild shock.

The erythrocyte count was 5,310,000 and the leukocyte count 3,250 per cubic millimeter of blood. The hematocrit reading was 51 per cent. The urine was normal.

The condition was tentatively diagnosed as a ruptured viscus and probably a ruptured peptic ulcer, and the patient was taken to the operating room.

When the abdomen was opened, the bowel content was free in the peritoneal cavity. The stomach and duodenum were normal. On further exploration a free perforation was observed on the antimesenteric border of the ileum, about 12 inches (30 cm.) from the ileocecal valve. The perforation was closed transversely in two layers, and the patient made an uneventful recovery. No biopsy specimen of the ulcer was taken.

CASE 2.—V. C., an Italian engine-watcher 61 years old, had been working daily and "feeling fine" until twelve hours prior to his admission to the hospital, at which time he had sudden severe colicky pain in the lower part of the abdomen, especially on the left side. He was given a hypodermic but had severe pain throughout the night. Next morning he had an attack of vomiting. There was no change in bowel habit; the patient had had a bowel movement on the previous day. He had lost no weight. It is noteworthy that he had undergone bilateral hernia repair seven years earlier but had no hernia at the time of this hospitalization. The pulse rate on admission was 82 per minute and the temperature 101 F.

Physical examination revealed no abnormalities except in the abdomen, which was flat, with boardlike rigidity and extreme tenderness throughout. There was marked rebound tenderness. No masses were palpable. Bowel sounds were absent.

The erythrocyte count was 4,800,000 and the leukocyte count 10,500 per cubic millimeter of blood, with 15.6 Gm. of hemoglobin. The value for lipase was 85, and for amylase, 48.

Roentgen examination revealed free air beneath both hemidiaphragms, but no abnormal gaseous distention of the small or the large bowel.

A diagnosis of perforated peptic ulcer was made, but when the abdomen was opened, although the duodenum and stomach were normal, a perforation of the ileum on the antimesenteric border was observed 18 inches (45 cm.) from the cecum. An elliptic segment about the ulcer was excised for biopsy, and the

bowel was closed transversely. Biopsy showed only acute ileitis and peri-ileitis at the site of perforation.

CASE 3.—A. D., a 62-year-old man with abdominal pain of ten hours' duration, was admitted to the hospital on Sept. 26, 1953. The onset of pain had been sudden and unaccountable.

There was a history of ulcer, but it had never been confirmed. The patient had been nauseated since the beginning of the pain, but had not vomited. He had obtained some relief from alkaline preparations, He stated that he had had a normal bowel movement on the previous day, but thought he remembered the fairly recent occurrence of tarry stools. There was no abdominal injury and no loss of weight. The past history was irrelevant. The pulse rate was 80, and the blood pressure in millimeters of mercury was 125 systolic and 70 diastolic. *A right inguinal hernia was present.*

Physical examination revealed essentially normal conditions except in the abdomen, which was flat and symmetric, with pain and tenderness in the whole lower part, most marked in the right lower quadrant. Rigidity and rebound also were most marked in this quadrant. Bowel sounds were present,

A roentgenogram taken with the patient in the upright position did not reveal any air under the diaphragm. The white blood cell count was 23,550 per cubic millimeter. Diagnosis of acute appendicitis or perforated peptic ulcer was made. Operation was performed through a pararectal incision, and free pus was observed in the abdomen. In the terminal portion of the ileum a perforation 1 mm. in diameter was present. This was inverted and covered with omentum, biopsy of the wall was not performed. The patient made an uneventful recovery.

CASE 4.—F. W., a woman aged 71, was brought to the hospital on Feb. 8, 1954, with sudden, severe pain in the right arm. She was hypertensive and diabetic, with a fibrillating heart and definite vascular disease. She was in shock at this time and had had a somewhat similar episode involving the left leg one year earlier.

The pulse rate was 82 and the blood pressure in millimeters of mercury was 206 systolic and 90 diastolic. She was treated for shock and given vasodilators. Dicumarol, depoheparin and oxygen were administered. She was taken to the operating room, a right thoracic paravertebral block was done. On the following day an embolectomy was performed in the right axillary artery. The next day another right paravertebral block was performed. The arm took on a good color and she was progressing satisfactorily until thirty-six hours after the operation, when sudden severe abdominal pain, distention and shock developed. I saw her four hours later in the terminal state, and suspected that she had mesenteric thrombosis or a dissecting aneurysm. She died within ten minutes. Autopsy revealed advanced arteriosclerosis, but there was also a free perforation in the upper part of the ileum for no apparent reason. There was no evidence of mesenteric thrombosis. *She did not have a hernia.*

RESUMEN

La ruptura espontánea del ileon es una entidad quirúrgica rara, habiendose comunicado en la literatura 50 casos. El autor comunica 4 casos más.

Dicha ruptura se presenta generalmente en los adultos, generalmente en la cuarta década de la vida aún cuando exitsen algunas comunicaciones de casos de niños.

En el pequeño grupo que se presenta todos los pacientes eran hombres con excepión de uno, una mujer anciana debilitada a consecuencia de otro proceso patológico.

Generalmente se presenta consecutivamente a un esfuerzo intenso.

En casi todos los casos se encuentra asociada una hernia.

En algunos casos la perforación ha sido determinada por adherencias de la víscera rota al peritoneo parietal o a alguna otra víscera.

El único tratamiento lo constituye la operación precoz. Con las técnicas quirúrgicas actuales y el control electrolítico y antibiótico, el grado de mortalidad debería de ser muy bajo.

RÉSUMÉ

La rupture spontanée de l'ileum est une condition chirurgicale rare, seulement 50 cas ont été reportés avant cette petite série de quatre. En général cette sorte de rupture est observée parmi des adults, le

plus souvent pendant la quatrième décade, tout de même assez de cas sont reportés, ou les patients étaient des petits enfants.

Dans ce petit groupe touts les malades étaient masculins, a l'exception d'une femme agée, débile à la suite d'autres conditions pathologiques.

En général cela arrive pendant un grand effort abdominal.

Presque touts les cas étaient accompagneés d'une hernie.

En quelques cas la perforation pourrait être influencée par des adhésions entre le viscère affligé et le peritoiné pariétal ou un autre viscère.

L'opération précoce et le seul secours. Grace à la technique chirurgicale d'aujourd'hui et le control des électrolytes et les antibiotiques la mortalité est extrèmement basse.

ZUSAMMENFASSUNG

Die Spontanrupter des Ileums ist eine seltene chirurgische Erkrankung, von der ausser der kleinen hier behandelten Serie von vier Faellen nur 50 Berichte vorliegen.

Im allgemeinen tritt diese Ruptur bei Erwachsenen—meistens im vierten Lebensjahrzent—auf, obwohl sich unter den berichteten Faellen auch einige Saeuglinge finden. Alle Kranken der Gruppe, ueber die hier berichtet wird, waren maennlichen Geschlechtes mit Ausnahme einer aelteren Frau, die infolge anderer Erkrankungen bereits sehr geschwaecht war. Gewoehnlich tritt die Erkrankung nach schwerer Beanspruchung oder Ueberanstrengung des Bauches auf. In fast allen Faellen bestand gleichzeitig eine Hernie. In manchen Faellen moegen Verwachsungen des Ileums mit dem peritonealen Bauchfell oder mit einem anderen Organ zur Perforation beigetragen haben.

Die einzige Behandlung besteht in fruehzeitiger Operation. Beim heutigen Stande chirurgischer Technik und unter Verwendung von Elektrolyten und Antibiotika sollte die Mortalitaet sehr niedrig sein.

RIASSUNTO

La rottura spontanea dell'ileo è un eventualità rara e nella letteratura ne esistono descritti solo 50 casi oltre a quattro nuovi presentati dall'autore.

Si verifica, di solito, nell'adulto (IV decennio) ma anche nell'infanzia.

Dei casi personali tre erano maschi, e una femmina in gravi condizioni generali per altre ragioni.

La rottura segue gravi lesioni addominali; in quasi tutti i casi vi era un'ernia; a volte la rottura era in rapporto con aderenze fra il viscere interessato e altri visceri o il peritoneo.

L'intervento precoce é l'unica cura possibile; la mortalità, al giorno d'oggi, é minima, grazie ai progressi della tecnica e delle cure postoperatorie.

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An Outline for Emergency Treatment of Catastrophic Burns

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THIS outline was prepared as part of the Civil Defense program of the Middlesex County Medical Society. Begun in 1948, it reached its present form after being tested in lectures to civil defense and first aid groups. Requests for copies of the outline, which I call "the Middlesex plan," have come from lay groups and from doctors in New Jersey and, to a limited extent, from other states. The importance of the subject in these troubled times, as well as the persistence of the requests, prompt the offering of the plan for publication.

Programs for treatment of burns are inseparable from the conditions in which they must be employed. To attempt to set a single "ideal" program would be utterly unrealistic. Between accidental, industrial and combat burns there are basic differences in the predominant nature of the injuries and in facilities for prevention and treatment. Civilian catastrophic burns involve totally different considerations, as to conditions and technics, from any of the above.

In general, an emergency program for civilian catastrophes must be simple, independent of laboratory aids and capable of being administered by lay attendants, alone or under limited direction. Conservation of time and material is essential. Instructions to first aid attendants must be specific, didactic and issued in the form of an outline or a semi-outline. This must include a list of alternate measures to be used in the probable event of shortages in materials.

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TABLE 1.—*Casualty Sorting: Priority of Evacuations*

No. 1.	Definitive surgical treatment urgent.
	Burns of pharynx
	Severe hemorrhage
	Open chest wounds
	Avulsion of limbs
	Penetrating abdominal wounds
No. 2.	Definitive treatment urgent, but no operation required for several hours.
	Burns of more than 20 per cent of the body surface
	Compound fractures
	Severe shock (traumatic or neuropsychic)
	Penetrating wounds of joints
	Small penetrating wounds of chest
	Crash injuries
No. 3.	First aid, followed by transfer to hospital of center for special treatment
	Burns of less than 20 per cent and more than 5 per cent of the body surface
	Burns of eyes (conjunctiva or cornea)
	Major head injuries
	Major eye injuries
	Major injuries to peripheral nerves
	Wounds of face
No. 4.	Patients who may be discharged after first aid or other simple treatment
	Minor burns (up to 5 per cent of the body surface)
	Contusions; lacerations; sprains
	Mild cerebral concussion
	Simple fractures of non-weight bearing bones

Casualties must be identified (if possible) and classified when first seen. Classification, in this instance, includes observation of the nature of the wound and its probable extent. This is then reduced to a single number that indicates the urgency of definitive therapy. For this purpose I have specified a tag made of linen or other durable material (Fig. 1). On this should be noted the name of the victim and/or the location where found. A prominent space

TABLE 2.—*Comparison of Surface Area Proportions for "Standard" Classification and Preliminary Sorting*

Part	Standard Andrew Classification [Berkow, 1924]		Subdivision	5 & 10 Method for Preliminary Sorting [1945]		Part
Head	6% [Includes neck]			5%		Head
Trunk	38%	20	Anterior Surface	20	40%	Trunk
		10	Posterior Surface	20 [& neck]		
Upper Extremities	17.5%	13.5	Arms & forearms	15	20%	Upper Extremities
		4.5	Hands	5		
Lower Extremities	38%	19	Thighs	20	35%	Lower Extremities
		13	Legs	10		
		6	Feet	5		

is provided on the tag for the number indicating the victim's priority of evacuation and the disposition of his case. My modification of Trueta's casualty sorting system, which should be taught to the first aid teams, is printed on the reverse side of the tag (Table 1).

For preliminary sorting of burns a very simple method of estimating the extent is required. The "5 and 10 method" is altogether satisfactory (Fig. 2). It was brought to my attention by a lieutenant in the U.S. Naval Reserve when we were stationed in Oahu, Territory of Hawaii, in 1945. Experience with hospital corpsmen and, in recent years, with first aid personnel has confirmed the statement of this lieutenant (whose name I unfortunately do not recall) that the "5 and 10 method" is easily taught to and applied by such attendants. The method is sufficiently accurate for its purpose (Table 2).

This outline is not presented as a "final" program. It is offered as a basis on which future and, it is hoped, better programs may be constructed.

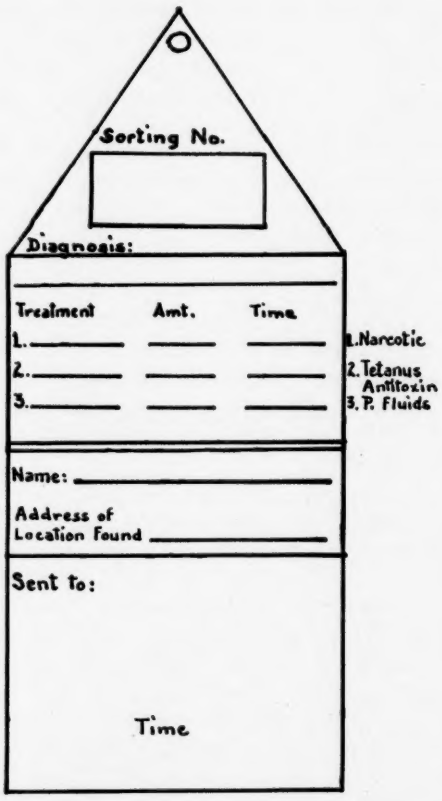

Fig. 1.—Tag used by author for accident victims, giving quick access to the main facts in the case.

GENERAL PRINCIPLES

Primary Classification

A. Minor burns

B. Major burns

A. Minor Burns

A burn is of minor extent when its area can be covered by the *two hands of the patient.*

Note: Do not classify as to depth, because: early determination is often impossible, several degrees may be present in the same patient, and depth is not important in *early* treatment, except for burns of the hands.

B. Major Burns

Under conditions of *major* catastrophe, any burn that cannot be covered by the *patient's two hands* presents hazard of shock and must be classified as a major burn.

Shock, actual or impending, is the most important consideration.

In first aid treatment, do not uncover the patient to determine the extent of a major burn. It is important to avoid chilling, pain and infection and to conserve time.

Lives can be lost by treating the surface wound. *Infection is probable; shock is certain!*

TREATMENT

I. MINOR BURNS

A. Purpose: To restore patient quickly to useful function in the emergency.

B. Immediate Objectives:

1. *Immediate* local therapy should be administered at once.
2. Dressing, especially on the hands, should not be so bulky as to prevent the patient from helping himself and others. *Shock is not a factor.*

C. Treatment depends on the *location* of the burns.

1. *Burns of hands and fingers*
   a. Preliminary cleansing with white soap and water is valuable but not essential.
   b. Apply wax paper or sterile petrolatum pads to both aspects of the hands and between the fingers to separate them. Cover with a mitten or a mitt-type dressing.
   c. For deep burns of the finger, place a roll of 2-inch or 3-inch bandage in the palm. Apply adhesive tape over the mitt to secure semiflexion of the fingers.
2. *Burns of eyelids*
   a. Most thermal burns of the eyes are burns of the eyelids. The rapid reflex closing of the lids protects the cornea and the conjunctiva.
   b. Apply petrolatum or other ointments, e. g., boric acid, penicillin.
3. *Burns of Conjunctiva and Cornea*
   a. Administer a single instillation of anesthetic ophthalmic ointment such as 2 per cent butynin oil.
   b. Label the patient with an appropriate tag identifying the eye burn. Note medication and time of instillation.
   c. Refer to the ophthalmologic service.
   Note: Do not bandage the eyes! 1. They must be observed frequently. 2. Some measure of sight may be essential.
4. *Burns of Other Locations*
   a. Cleanse with white soap if possible; this is useful but not essential.
   b. Apply bland ointment, e. g., petrolatum or cod liver oil, preferably incorporated in the bandage. Sterile waxed paper may be used. All these are preferably incorporated in *c.*
   c. Apply a firm dressing, bulky enough to protect the injured part but not so bulky as to make the patient helpless.
5. *Do not give morphine to a patient with minor burns, because the patient may become unable to help himself and others in the emergency.*

II. MAJOR BURNS

Policy:

1. Employ a simple technic, conserving time and material.
2. Place no dependence on laboratory aids.
3. Treatment should be specific but so planned as to permit substitution and improvisation.

Primary Objectives:

1. To relieve pain.
2. To prevent or combat shock as promptly as possible.
3. To protect the burned area (which is an open wound) from further contamination. *Infection is probable; shock is certain!*

First Aid Treatment

This is administered by first aid men or physicians in the most forward dressing station. After determining that the burn is of major extent:

1. *Relieve Pain*
   a. Drug
   Preferred: Pantopon, 1 gr.

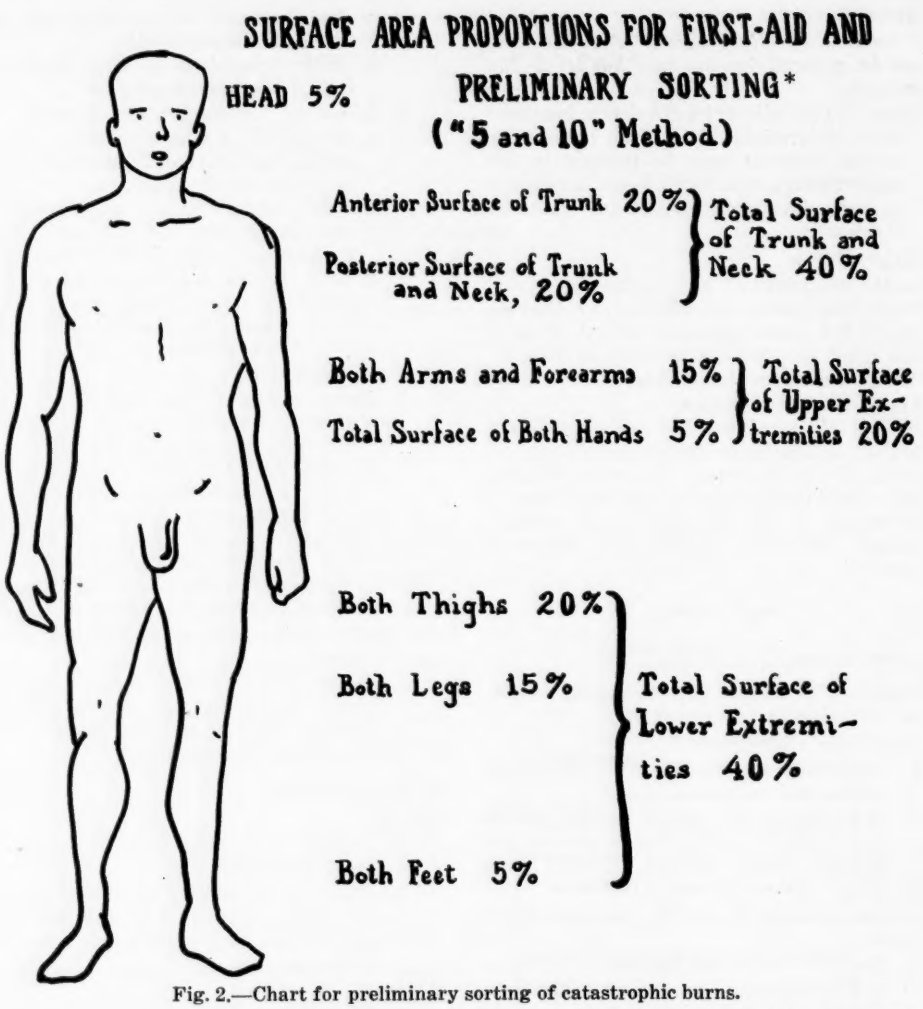
SURFACE AREA PROPORTIONS FOR FIRST-AID AND
PRELIMINARY SORTING*
("5 and 10" Method)
HEAD 5%
Anterior Surface of Trunk 20%
Posterior Surface of Trunk and Neck, 20%
Total Surface of Trunk and Neck 40%
Both Arms and Forearms 15%
Total Surface of Both Hands 5%
Total Surface of Upper Extremities 20%
Both Thighs 20%
Both Legs 15%
Both Feet 5%
Total Surface of Lower Extremities 40%

Fig. 2.—Chart for preliminary sorting of catastrophic burns.

*Author's corrections received after engraving was made: 1. For "Both Legs 15% of" read "Both Legs 10%." 2. For "Total Surface of Lower Extremities 40%" read "Total Surface of Lower Extremities 35%."

2d choice: Morphine, ¼-½ gr. (Morphine is not preferred, because it aggravates anoxia.)
3d choice: Codeine, ½ gr. (Codeine is less effective and is apt to produce nausea and vomiting, increasing dehydration.)
4th choice: Barbituates.

b. Method of injection
Preferred: Disposable syrette.
2d choice: Syringe.

c. Mode of injection
Subcutaneous
Intravenous

2. *Combat Shock*
1st choice: Plasma and hyaluronidase, administered by subcutaneous infusion to avoid dislodgement of the intravenous needle in transporting the patient. Fix the needle firmly in the skin with ample adhesive plaster dressing.

2d choice: Plasma substitutes, electrolyte (saline solution, etc.) Inject hyaluronidase locally, if available.

3. *Initial Dressing*
   a. Do not remove clothing adhering to burn.
   b. Wrap burned areas, or patient, in clean (sterile, if possible) sheet.
   c. Do not apply ointments, tanning agents or *anything* to the wound.
   d. Evacuate to hospital or burn center.
4. *Record*
   Record on patients label
   a. Drugs
   b. Dosage
   c. Time of administration

SUMMARY

The author presents a working plan for the emergency treatment of burns, both major and minor, due to catastrophe. The plan is one that can be carried out by lay personnel if necessary. Emphasis is laid on the need, in all such instructions, of clarity and practicability. As far as possible, dressings applied to patients with minor burns should be kept light enough to enable the patient to help himself and others in the emergency.

ZUSAMMENFASSUNG

Der Verfasser legt einen Arbeitsplan zur Notbehandlung von groesseren und kleineren Verbrennungen bei Ungluecksfaellen vor. Der Plan laesst sich im Notfall von Laienpersonal ausfuehren. Es wird hervorgehoben, dass alle derartigen Instruktionen unbedingt klar und praktisch ausfuehrbar sein muessen. Kranke mit geringen Verbrennungen sollen, wenn irgend moeglich, nur leichte Verbaende angelegt bekommen, die es ihnen ermoeglichen, sich selbst und anderen im Falle einer Katastrophe zu helfen.

RIASSUNTO

L'autore descrive un progetto per la cura d'urgenza delle ustioni di qualunque grado che possono verificarsi durante una catastrofe. Il piano é studiato in modo da poter essere attuato anche da personale non specializzato, se necessario, ed é basato su istruzioni chiare e pratiche. Le medicazioni applicate agli ustionati più leggeri devono essere abbastanza semplici da consentire ad essi di aiutarsi da soli e di portare eventualmente soccorso anche ad altri.

RESUME

L'auteur offre un plan pour le traitement de brûlures — sévères et insignifiantes — causées par une catastrophe. Le plan est tel, qu'il peut êtr e executé par une équipe non professionelle, si nécessaire. Il est important, que de telles instructions soient claires et pratiques. Autant que possible les pensements appliqués aux malades ayant des brûlures légères ne doivent pas être embarassants, de sorte que le patient peut s'aider à lui même et aux autres en cas d'urgence.

RESUMEN

El autor presenta un plan de trabajo para el tratamiento de quemaduras, mayores y menores, debidas a algún accidente. El plan puede llevarse a cabo precindiendo de personal si es necesario. Se señala la necesidad en tales circunstancias de claridad y de aplicación práctica. En lo posible el aposito del paciente con quemaduras menores debe ser lo suficientemente ligero para que el paciente ayude en el accidente.

Stainless Steel Wire as Suture Material

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WATERLOO, IOWA

IN this paper, which is restricted to a comparison of wire and other suture material employed in major surgical procedures, I shall first recount a brief history of wire sutures and then report 3,053 cases in which wire was used as suture material. Stainless steel wire in my hands has proved to be a superior suture material and, in my opinion, will continue to become more popular at the expense of other suture material. It does have certain disadvantages, and these, as well as its good points will be brought out.

The use of metallic sutures is not new, for gold wire was used by the ancient Greeks as suture material. Metallic sutures were then forgotten until early in the nineteenth century, when J. Marion Sims[11] used metallic sutures to close vesicovaginal fistulas. He first used lead wire and later used silver wire. Sims is said to have achieved successful closure of some 200 vesicovaginal fistulas by using silver wire.

Metallic suture material, however, did not become popular until 1930, when fine annealed alloy steel wire was available. During the next seventeen years Babcock[1] reported its use in over 20,000 operations at Temple University. Of 4,000 abdominal operations the wounds in 2,000 were closed by an all-wire technic, and only 1 patient had a wound separation.

In 1943 Dulin[2] reported the use of alloy steel wire in 4,500 cases with a marked reduction of wound infections and wounds which showed less postoperative tenderness, edema and tumescence.

The fallacy that wire sutures become ionized, undergo electrolysis, liberate metals that form poisonous salts in the tissues, and cause undue tissue necrosis and fibrosis is a "carry-over" from the days of trial and error with silver, aluminum, copper, and such alloys of dissimilar metals as bronze, German silver, brass, magnesium compounds, carbon steel and the many forms of stainless and rustless steel. It must be emphasized that only 18-8 or 18-8 SMO stainless steel and tantalum wire sutures are now considered acceptable for surgical use. Vitallium is relatively nonirritating to the tissues but is too brittle to be used as a surgical wire. The usual stainless steel wire is made up of 18 to 20 per cent chromium, 8 to 10 per cent nickel and 70 to 74 per cent steel, in sizes 40-14B and S Gage.

Wire is impermeable to organisms, differing in this from catgut, silk or cotton. When wire wounds become grossly infected, the sutures remain intact and firm. Healing occurs after control of the infection. There are disadvantages, however, in the use of wire; the surgeon cannot work as fast with wire as with other sutures, for the knots tied with wire must all be square knots; he must not kink the wire, and he must not tie it too tightly; the ends of the wire suture must be cut flush with the knot so that no sharp ends will cause pain. It is very difficult to teach an assistant to use wire properly on the first day or during the first week, for it has to be handled and used differently from other suture materials. The possibility that a member of the operating team may incur a puncture wound of the hand is a constant hazard.

Wire is an excellent suture material because of its tensile strength and good

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tissue tolerance. Surgeons need a suture strong enough to hold the tissue edges together until healing has occurred. If one compares the tensile strength per unit of diameter for various sutures, one finds that chromic catgut is stronger than plain catgut and that cotton is stronger than catgut but not as strong as silk. Wire is superior to all; in addition, the strength of wire does not vary. Other sutures, particularly silk, lose much of their strength as a result of heating and drying during sterilization. It should be emphasized, however, that the superior qualities of wire that produce improved wound healing are not due to its physical properties or strength but rather to tissue tolerance of its presence. Dulin[2] reported, "Wounds closed with buried wire are comfortable for the patient. The increased comfort decreases the frequent requirements of morphine. Coughing and deep breathing are much easier. There is a lowering of the incidence of pulmonary complications, phlebitis and bladder retention."

This was confirmed by Wu and Pai,[14] who made a detailed study of the irritating effect of catgut and silk and the desirability of wire. Experiments were made with wire and catgut, results being checked at the end of five days. Where wire had been used the microscopic studies revealed a slight infiltration of round cells, fibroblasts and a few plasma cells in the region of the sutures. In marked contrast, where catgut had been used the microscope revealed a dense infiltration of leukocytes with fibrosis, exudate, edema and some formation of small abscesses. Necrotic areas were observed in the nearby muscle tissues.

Fred[3] of Boston, using wire sutures in rhinoplastic operations, has left them in place (to approximate the cartilage) for eleven months to several years. He has encountered no infection or trouble in 250 consecutive cases. Large[7] of Philadelphia used stainless steel wire in the repair of cleft lip and cleft palate without a failure in 50 consecutive cases, and thereby eliminating multiple secondary procedures. In 1953 Freiheit and DeVillers[4] reported 500 consecutive major abdominal operations in which closure with an all-wire technic was performed. No wound complication occurred in the entire series, and over 80 per cent of the patients went home on the fourth or fifth postoperative day. Woodruff[13] of Denver reported a similar series of 300 consecutive major abdominal procedures in 1954. There were no postoperative wound ruptures and no infection in the series.

Wire may be used in many ways and many forms and is always far superior to other sutures, as was proved by Madsen[8] of Copenhagen, Denmark, who performed 650 functional tests on various suture materials. These were carried out, in 37 rabbits and 1 human volunteer, with buried interrupted sutures in fascia in the abdominal wound and the musculofascial tissue of the back. He used catgut, silk, linen, and stainless steel wire. Hawkins and Hans[5] of London, England, after using stainless steel wire sutures in abdominal incisions for seven years without regret, have reported its advantages over tantalum wire. They tried braided tantalum wire (gage 0) because, being flexible, it would not kink like stainless steel wire. This braided tantalum was used in four London Hospitals for seven months in 1950 before they realized that it had certain considerable disadvantages as compared with alloy steel wire. Postoperatively, in many patients, persistent sinuses, and stitch abscesses and hernias developed. Of 136 patients whose abdominal incisions were closed with this wire (tantalum) sepsis in the scar developed in 11 and incisional hernias in 9, and in 6 of the cases it was necessary to remove the wire before healing took place. Hox-

worth, Sullivan, and Ginseffi[6] of Cincinnati reported the use of rectangular rigid spring-tempered stainless steel wire clips to close abdominal fascia. They observed that this reduces the element of "shear" (caused by the distribution of stresses upon the fascia by flexible suture material) and thereby increases the holding power of the wound closure. In 1954 they reported the cases of 161 patients with abdominal wounds closed in such a manner with excellent results.

Stainless steel wire is also used as a continuous and a removable suture. In 1952, Robinson[9] of Kankakee, Illinois, reported 505 cases in which No. 3-0 braided steel wire was used as a continuous suture in all kinds of abdominal incisions over a four-year period, with excellent results. He stated that in this series, as compared to a series of 620 similar cases in which interrupted wire sutures were used, there were fewer wound infections and broken sutures.

Schulte and Lyons[10] of San Francisco reported the use of a sliding, self-adjusting suture of continuous No. 28 or No. 30 wire providing even tension throughout the suture line without tissue strangulation. This is accomplished by multiple running wire sutures extending beyond the limits of the incision and either tied or wound together. These are cut and removed after healing has taken place.

I should like to report 3,053 major surgical operations in which stainless steel wire was used in a part-wire or all-wire technic from Jan. 1, 1944, to Jan. 1, 1954. In all of the operations stainless steel wire was used to close the fascia and skin. In many, including gastric resections, colon resections with end-to-end anastamosis, thyroidectomies, radical mastectomies, abdominal perineal resections, nephrectomies, and cholecystectomies with common duct explorations, an all-wire technic was used. It was quite apparent that the convalescence of all the patients so treated was smoother and quicker than that of the others, even though the technic takes a bit longer. Wire sutures were used as suture material for the stomach, intestine, gall ducts, pancreatic ducts, bladder, ureter, vagina, pelvic floor, peritoneum, dura, blood vessels, muscles and tendons. It also was used many times for ligation and as a purse-string suture for the base of a gangrenous appendix. Many of the patients who underwent radical mastectomy with an all-wire technic have had roentgen therapy without evidence of damage or trouble.

Of these 3,059 cases there were evisceration in 3 and wound infections in 7. The three eviscerations occurred in middle-aged persons, each with a midline longitudinal incision in the upper half of the abdomen. All 3 of these were short, stocky persons who had postoperative ileus with a great deal of distention. They were returned to the operating room, and closure was made with through-and-through heavy wire sutures. All 3 made an uneventful convalescence after this secondary closure. I might add that in 17 of the cases, after a primary exploration when only a colostomy was done, the incision was closed with through-and-through 25-gage wire, reopened five to ten days later through the same incision for the bowel resection and closed again with through-and-through wire sutures. All 17 healed by primary intention, without postoperative hernia. Of the 3,059 cases, wire sutures were removed with the region under local anesthesia in 14. They were removed because one or more of them had become painful, and in all cases the suture either had not been tied in a square knot or had been cut too long by the assistant, who was not well trained in the use of wire sutures.

Thus I have found, as have others, that stainless steel wire is the most satisfactory

of all suture materials. It is unsurpassed in tensile strength and in its quality of being tolerated by the tissues without inflammatory reaction. It is not foolproof, however; Trimpi and Bacon[12] of Philadelphia have reported that dehiscence of wounds will occur even with good interrupted wire closure. This occurs most commonly in the stocky, well developed, healthy, barrel-chested, middle-aged man with increased intra-abdominal pressure. In this type of patient, if retention sutures of No. 25 stainless steel wire are used for additional strengthening of the wound, dehiscence is reduced nearly to zero.

RESUMEN

De acuerdo con el autor el mejor material de sutura es el acero inoxidable. La técnica empleada debe ser perfecta ya que solamente deben hacerse nudos cuadrados y el alambre no debe ser doblado. Debe de tenerse cuidado en campos infectados con el objeto de evitar picaduras en las manos del cirujano.

Cuando el peligro de infección o las malas condiciones del paciente requieren una técnica con el uso de alambre solamente, los resultados obtenidos han sido satisfactorios.

RIASSUNTO

Le suture in filo d'acciaio inossidabile sono di gran lunga superiori a tutte le altre, secondo l'opinione dell'autore. La tecnica deve essere molto corretta: solo nodi diritti, evitare che il filo si ripieghi, evitare che l'operatore si punga le dita quando opera in terreno infetto. Nei pazienti con grave pericolo di infezione o in cattive condizioni generali si é usato soltanto filo d'acciaio con risultati soddisfacenti.

RÉSUMÉ

L'auteur constate, que le fil d'acier inoxydable surpasse n'importe quel autre matériel pour couture. Il faut, que la technique, Soit parfaite, parce que seulement des noeuds rectangulaires doivent être noués et le fil ne doit pas se plier. Dans les cas infectieux il faut bien faire attention, de ne pas avoir les doigts piqués au fil.

Dans les cas, ou le danger d'infection ou la mauvaise condition du malade demande l'usage unique du fil d'acier, les résultats étaient toujours satisfaisants.

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Excision of Tuberculous Cavity for Pulmonary Tuberculosis

Report of a Case

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THE history of direct attack on the lesion in the treatment of pulmonary tuberculosis is a fairly long one. Ruggi made successful excisions in 2 cases of apical pulmonary tuberculosis in 1882, and his report was followed by those of Kronlein and Block in 1882, Tuffier in 1891 and Lawson in 1903.

Tuffier and De Grenville were the first to open tuberculous cavities by direct attack. Sonnenburg obtained cures in 3 of 5 cases by this method, which was later praised by Lovelage. Sauerbruch and Lilienthal were also interested in this subject. Bernou and his co-workers recommended extirpation and fulguration for cavitary tuberculosis and excision for the superficial caseous type.

REPORT OF CASE

F. S. of Sebinkarahuisar, a man 24 years of age, had been subjected to various courses of treatment over a period of five years for a tuberculous lesion in the left lung. During the most recent course of treatment in the tuberculosis clinic of this hospital it was decided that the lesion was unamenable to conservative treatment, and the patient was referred to my service for operation.

According to the account given by the patient, who on admission complained chiefly of nonproductive cough and pain in the posterior part of the chest, his illness had begun with coughing, night sweats and loss of weight. At an examination made five years earlier, a tuberculous infection of the left apical region had been detected. Sanatorium treatment resulted in amelioration of the symptoms. Because of a recurrence, however, this time with hemoptysis, he was hospitalized again in October 1952, and streptomycin combined with isonicotinic acid was administered.

At the time of his admission to my service the patient weighed 82 Kg. The pulse rate was 95 per minute and the temperature 37 C. Clinical examination revealed some crackling sounds in the left apical pulmonary region but no other abnormalities were observable.

The erythrocyte count was 5,000,000 and the leukocyte count 9,360 per cubic millimeter of blood, with 90 per cent hemoglobin. The bleeding time was five minutes. The Wassermann and Kahn reactions were negative. The blood was of Group A. There were no tubercle bacilli in the sputum. The respiratory capacity was 2,400 ml., and the sedimentation rate was 0.5 mm. in the first hour, 15 mm. in the second and 20 mm. in the third. There was no albumin or sugar in the urine. The urinary sediment contained occasional oxalate crystals and a

Fig. 1.—Thoracic roentgenogram showing thick-walled tuberculous cavity (see text).

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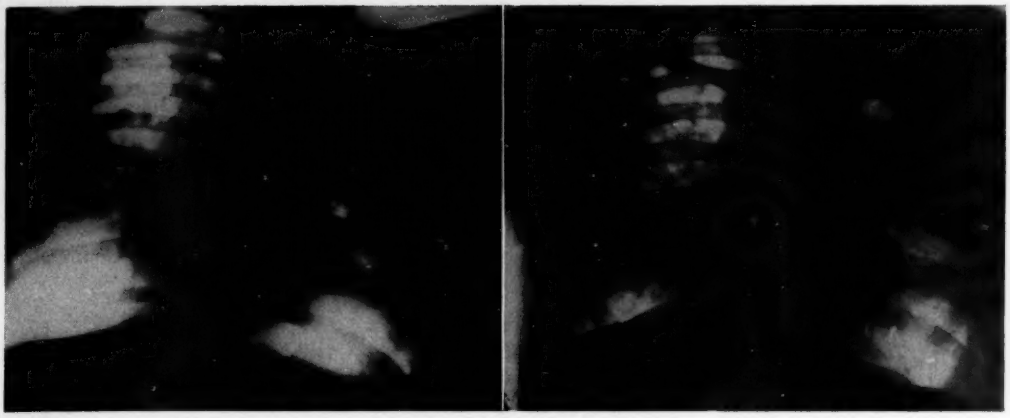

Fig. 2.—*Left*, roentgenogram showing cavity projected to its fullest extent (see text). *Right*, roentgenogram taken after excision of cavity.

very few red and white blood cells.

A heavy-walled cavity the size of a hen's egg was seen in a roentgenogram of the chest (Fig. 1). The planigraph revealed that this cavity was visible in films taken at distances of 6 to 13 cm., its walls being most clearly perceptible at 7 cm. This was identical with the picture presented by the cavity projected to its widest extent (Fig. 2).

Surgical intervention was deemed advisable, since medical treatment had failed and the patient's general condition was suitable for operation. On May 28, with intravenous pentothal and endotracheal gas-oxygen-ether anesthesia, the pleural cavity was entered after partial resection of the paravertebral segments of the third and fourth ribs. The portion of parietal pleura overlying the cavity was thickened and firmly adherent. Separation of the overlying two layers of pleura was dispensed with, and, after strict and deliberate location of the cavity with a hollow needle, the strong wall was incised. Complete excision of the cavity from the soft lung tissue was completed by blunt gauze dissection. There was no significant bleeding from the remaining defect, which was filled with streptomycin and fine packing. A transfusion (500 ml.) was given during the operation, and parenteral streptomycin combined with oral para-aminosalicylic acid was administered during the postoperative period. On the eighth postopera-

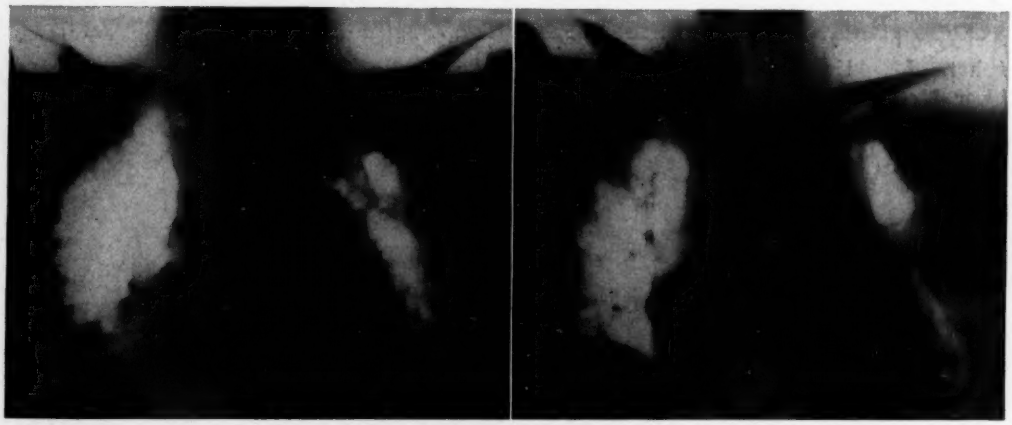

Fig. 3.—Two additional postoperative roentgenograms, showing perfect healing at site of lesion. See also Figure 2, *right*.

tive day the packing and the cutaneous sutures were removed. Later, clinical and roentgen examinations (Fig. 3) revealed perfect healing at the site of the lesion. On the twenty-fifth postoperative day the patient was discharged.

Microscopic examination of the extirpated cavity by Dr. B. Pars, pathologist, revealed fibroblasts, polymorphonuclear cells, necrotic areas and occasional Langhans giant cells. There was inflamed granulation tissue containing abundant lymphocytes, and capilliary vessels were observed in the outer parts of a layer surrounded by atelectatic pulmonary tissue. Atelectatic pulmonary vesicles, swollen endothelial cells, thickened septums, lymphocytic infiltration, numerous foci of Langhans giant cells and particles of coal were observed in the periphery of this zone. The diagnosis was chronic tuberculous cavity of the lung.

SUMMARY

A case is reported of apical tuberculous cavitation cured by cavernectomy with the aid of antituberculous drugs, modern anesthesia and rehabilitation, without reference to such methods as partial excision or lobectomy and pneumonectomy, the history of which extends to the days of Friedlander and Beye.

ZUSAMMENFASSUNG

Es wird über einen Fall von kavernöser Lungenspitzentuberkulose bei einem 24-jährigen Manne berichtet. Es wurde mit Erfolg eine Resektion der Kaverne ausgeführt. Mit Unterstützung antituberkulöser Medikamente, moderner Anästhesie und Wiederherstellungsmethoden erübrigte es sich, zu anderen Verfahren wie zur Resektion eines Segments oder eines Lappens oder der ganzen Lunge zu greifen.

RIASSUNTO

Viene riferito un caso di caverna tubercolare dell'apice polmonare in un uomo di 24 anni. Venne eseguita con successo la cavernectomia, con l'aiuto dei moderni farmaci antitubercolari, dell'anestesia e delle altre forme moderne di assistenza, che consentono di evitare interventi più mutilanti come la resezione, la lobectomia, la pneumonectomia.

RESUMEN

Se comunica un caso de tuberculosis pulmonar con cavidad apical an un hombre de 24 años de edad. Se hizo la resección de la caverna con éxito, con la ayuda de drogas antituberculosas, anestesia moderna y rehabilitación, sin recurrir a tales métodos como la extirpación parcial o lobectomía y total o pneumonectomía.

RÉSUMÉ

L'auteur raporte un cas de cavité tuberculeuse pulmonaire apicale d'un homme âgé de 24 ans. La cavernectomieá était exécuté avec succes, grace aux medicaments antituberculeux, anesthésie moderne et rehabilisation, sans avoir recours à des méthodes telle que l'excision partielle ou lobectomie et pneumonectomie.

Knowledge and timber shouldn't be much used till they are seasoned.

—*Holmes*

Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S., EDITOR

The Multidiscipline Approach to the Treatment of the Child with Cleft Palate

Introduction

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THERE are, it seems to me, two ways of looking at cleft palate and cleft lip. It may be viewed as a congenital malformation and disfigurement of body architecture and hence described as a noncontinuity of the tissues of the roof of the oral cavity and the upper lip, arising from the arrest or deceleration of growth processes during early fetal life.

For many years this interpretation has determined and directed the pattern of medical and surgical care of children with cleft palate. The history of the surgical treatment of such children is impressive in its illustrations of imagination, resourcefulness, inventiveness, skill and experimental attitudes. There is nothing essentialy wrong with this view, except that it is incomplete. As a consequence, the therapeutic programs it has produced are inadequate because they are incomplete.

But there is another way to look at the same phenomenon. It, too, includes concern with the body structures, but it goes farther. It focuses its primary concern on *the child who has the deformity.* The anatomic aberrancy is given significance by such questions as these: What does this deformity do to the child? How will it affect his life, not only in infancy, but as a school-age child, as an adolescent and as an adult? How will it modify his physiologic, mental, emotional and social life? What difference will it make to his parents, his siblings, his schoolmates, his sweetheart, his wife, and his vocational associates? Finally and most important, how will it condition the way he feels about himself?

Such inquiries place the purely surgical treatment in a long and quite different perspective. Satisfactory replies to these and similar questions emphasize the necessity for a more inclusive form of medical, surgical, educational and social treatment of this child. It means, of course, that, important and basic as it may be to close the palate and the lip, the value and meaning of this surgical act must, in the end,

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be measured in terms of what it will do to and for *all* of the patient, *all* of his life.

Approaching cleft palate from this view is at once sobering and challenging. It adds new dimensions that may cause the right-minded surgeon to feel inadequate and the insecure surgeon threatened. In a number of places in the United States the child with a cleft palate has been subjected to improved study. This study has made it clear that the needs of such a child are both numerous and complex. It is evident that many children have been helped — some in one way, some in another. But it is regrettable to discover, too, that a great many have been irreversibly harmed. Their last state is truly worse than the first.

One is compelled to admit that both the help and the harm have been, to some degree, products of the point of view and the methods of classic and orthodox medicine. Lines of specialization have become barriers that have deterred the flow of ideas and produced isolation of the specialist from his fellows and from his patients. The resulting practices have discouraged the cultivation of attitudes and skills in *working together*.

In some medical centers the child with cleft palate has provided an opportunity to examine and apply the technics of the design of specialist teams. The organization of specialist teams is not new. Science, industry and education have learned that, by truly scientific cooperation, ends can be achieved that cannot possibly be attained by the solitary worker. Team activity is recent in medicine. The term "medical team" has become a slogan and a label, and, since in popular and professional converse it has become somewhat superficial, it deserves a more serious examination.

From our work together at the Cleft Palate Center of the Professional Colleges of the University of Illinois, my colleagues and I have begun to evolve some principles and practices which, in our opinion, are deserving of communication. First, a team in medicine can scarcely ever be "medical" in the limited way in which the term "medical" is ordinarily applied. Its structure requires the inclusion and integration of disciplines that may, by tradition, appear to be alien to classic medicine and to each other. Coming as they do from a wide variety of educational and experimental backgrounds, the members of such a team bring with them the knowledge, attitude, habits of mind, specialized terminology and technical skills that characterize their profession.

It is an error to think that mere physical propinquity — "calling a meeting" — creates a team. Several persons in the same room, or even considering the same problem, are not necessarily a team. The group dynamic that makes a team something wholly different from a group of persons who get together to "talk over the patient" is the product of a painful maturation. A real team of specialists has what I like to call the "quality of organism." A unique kind of multidimensional interpersonal relation gives it the attribute of corporateness. In this quality of corporateness lie its effectiveness and its strength.

The reduction of the barriers between the specialists is often traumatic. Human beings relinquish their prejudices unwillingly. They defend their judgments and practices jealously. They value their independence abnormally. They are suspicious of what they do not know and do not understand. They feel threatened by the fact that other members of the group may disturb their areas of dominance. But there are bases upon which a team structure can be built. Most important is the development of communication channels. This requires the acquisition of a new vocabulary. The members of the team must learn

to talk to each other.

The revised communications, moreover, must have important ends. In my opinion, these ends are supportive research and improved clinical service to the patient. Unless new information, new facts and new interpretations are fed into a team, it soon disintegrates. A team is soon dead if it merely provides a climate in which each member ventilates his opinon, cultivates his mental rigidities and rehearses his stereotyped behavior. A foundation of research interest continuously adds something new, reorganizes the old and forms a common bond of possession.

In the area of improved clinical service to patients, it is important that each specialist interest himself in the specialty of the *other* members of the team. In the clinical team of the Cleft Palate Center of the University of Illinois the following specialties are represented: Pediatrics, maxillofacial surgery, otorhinolaryngology, pedodontia, orthodontia, prosthetics, speech therapy, social work, nursing and the parenthood. When in action, it is characteristic of this team that sharp individuality and exact professional identity are blended with the total group personality. A dentist may proceed like a surgeon, a surgeon behave like a speech pathologist, a speech pathologist act like a social worker, an otolaryngologist examine a patient like a pediatrician and a pediatrician conduct himself like everyone else. The team examines the patient together, the observations and the history are discussed together, plans are laid together; in the proper time sequence, each provides his special knowledge and contributes his unique skills, and then, from time to time, the patient's condition is reevaluated by all.

It might be asked, "Is this not confusing to the parents? With whom do they establish a clinical relation? Who is their doctor?" When the team has matured it may be any member, for each is then prepared to make appropriate interpretations and give the correct counsel. The reader is probably asking, "Who is boss in such a group?" and the answer may both surprise and disturb him. There is no evidence that any specialty qualifies its members any better for leadership in the team activity than does any other. It is exclusively a matter of the qualities of the individual member as a personality. It must be admitted that the professional philosophy of some specialists makes it difficult for those who practice these specialties to be good and acceptable leaders. The authoritarian, dogmatic, inflexible and nonresiliant personality will dwarf and thwart the development of the team. Teamwork offers a poor climate for those who entertain a Jehovah complex.

Finally, what special advantages does a treatment program directed by a team have over one that is not so directed? This depends somewhat upon the complexity and the seriousness of the disability. In treatment of cleft palate it is more likely to assure that the right thing is done by the right person at the right time.

Scientific progress is like mounting a ladder; each step upward is followed by a brief pause while the body regains its balance, and we can no more disregard the steps which have gone before than we could cut away the lower part of the ladder.

—*O. G. Sutton*

The Multidiscipline Approach to the Treatment of Cleft Palate in Children

Integration of Multiprofessional Resources Through a Program of Basic Research*

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THE research program of the Cleft Palate Center of the University of Illinois was designed primarily to provide solutions to a number of clinical problems. Simply stated, all of these problems can be resolved into three questions: What should be done for a child with a cleft lip and palate? When and how should it be done? Does the treatment vary from child to child?

Of course, it was impossible to go off in every direction and at once solve all of the problems. As an alternative, my coworkers and I sought to define and state clearly certain questions we held basic to the solution of all the other problems. Our hope was that, once these central problems were solved, derivation of the answers to all the other questions would be greatly catalyzed.

But how does one go about asking that question which will unlock all of the answers desired? To ask a question of nature one must first possess a repertory of ideas. As we scanned the situation, it was evident that, despite the best efforts of our leading plastic surgeons, the results of surgical repair of the cleft palate were not uniformly successful. In some instances, the maxilla failed to develop properly and speech was unintelligible. In others, speech developed satisfactorily but facial growth was inadequate, while in some the reverse conditions prevailed. And, paradoxically, a few persons whose palates were never operated upon demonstrated poor maxillary growth and intelligible speech.

There could be no question that poorly conceived, badly executed and ill-timed operations were to blame for the poor results in many cases. Consequently, there developed a movement to delay surgical treatment of the palate until school age in order to minimize the deleterious effects upon facial growth. Presumably, proponents of this school of thought assumed that all operations upon the palate posed a definite impediment to the natural growth processes of the maxilla. By delaying operation, they hoped to minimize the retardation of facial growth. In part this point of view was justified, but it did not take into account certain facts. For example, there are a number of cases on record in which facial growth and speech development are within normal limits despite the fact that the palate was repaired before the child was a year old.

It became increasingly clear that cross-

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sectional analyses of the various samples of clefts operated on and those not operated on did not unmask all of the unknown facts. Too many variants were operating to permit the formulation of simple and all-inclusive rules, such as fixing the age at which all clefts of the palate should be repaired. It was also apparent that certain biologic variations existed which were beyond the control of the surgeon and that these variations could spell the difference between therapeutic success and failure. Our task, then, was to identify and analyze these differences among patients and to employ them in the development of a scientific basis for differential dagnosis, a rationale for therapy and a means of prognosticating the ultimate anatomic and functional result.

As fact and fallacies were separated from the tangled web of information, it became clear that significant advances in the treatment of children with cleft lip and palate would depend in large part upon knowledge of (1) their differences from the normal child and (2) their individual potentialities for growth and development.

For these reasons, we agreed to direct our resources into a longitudinal growth study of newborn infants with clefts of the lip and palate. This study was designed to answer two fundamental questions: First, what is the growth potential of the head of a child with a cleft? As a control for this phase of the study, a considerable fund of knowledge was already available on the growth of the head of the normal child.[1,2] Second, we sought to determine whether the present-day methods of plastic surgery utilized in the repair of clefts of the lip and palate altered the pattern of growth of the head. Finally, we wished to analyze the variations presented by different operative technics and by the age of the patient at operation, so far as they might determine the ultimate success of the habilitation program. In selected cases, when surgical repair of the palate was not deemed the treatment of choice, an opportunity was provided to study the long-term result of introducing a speech appliance. Our primary objective was not to defeat or even test the validity of prevailing concepts, but rather to seek out the biologic mechanisms that influence the success or failure of efforts to treat the individual child.

This longitudinal growth study has been in continuous progress for the past five years and now includes data on more than 400 different persons. Since the general theme of this panel is the multidisciplinary approach, it will be worth while to note an unexpected but important by-product of this research and its contribution to interprofessional communication. Therefore, the practical results of our investigations will be described primarily as they relate to the development of communication between the various specialties and the synthesis of a team.

The semantic and emotional barriers to the effective operation of a multiprofessional team have already been described by the chairman of this panel.* He has mentioned the difficulties encountered in integrating the individual talents represented in such a group. In the course of our growth as an organized unit in the environment of a large university, it was observed that as our research activities grew the barriers between various specialties tended to dissolve, and diverse talents and personalities were welded into an effective team. To be sure, there was a weeding-out process and there were casualties, for in an atmosphere of research dogmatism could not flourish for long.

By what magic did surgeons, pediatricians, dentists, speech pathologists, social workers and others come to work together

*Baker, H. K.: The Multi-Discipline Approach to the Treatment of the Child with Cleft Palate: Team Design.

in harmony? It was not by edict but by a process of evolution fostered by extraordinary leadership and favored, it seems, by Providence. In retrospect, it is also possible to identify certain events operating in our favor that were definitely tied to the supportive activity of the research program. The elucidation of these events in the chronologic order of their occurrence is the primary concern of this paper.

Seeing Things Together from Their Beginnings.—Let us examine for a moment the usual sequence of events following the birth of a child with a cleft lip and palate. Sometimes the obstetrician or pediatrician may be sufficiently well informed to outline the general problem and provide intelligent guidance to the distressed parents. Often the family is referred directly to a plastic surgeon, and the responsibilty of planning the entire program of habilitation, extending over a number of years, is delegated to the surgeon.

The omniscient plastic surgeon is expected to know when the child requires speech therapy, when braces should be placed upon his teeth, how to control his hearing loss and when to remind the parents to take care of his teeth. Now, suppose the surgeon assumes all these responsibilities and refers the child to some other specialist. The chances are that the next doctor on the assembly line has no concept of what this child looked like when he was born, nor does he appreciate the changes induced by surgical intervention. What is even worse, he is seldom given the opportunity to recognize the relation of his own special efforts to the total program of habilitation. Under such circumstances therapy is piecemeal, and, because of the lack of communication, one doctor may unwittingly work at cross purposes with another.

Basically at fault are the divisive system of specialization and the lack of opportunity for the exchange of knowledge between different specialties. Each man contributes but a fragment to the habilitation of the handicapped child, yet his effort is directly related to the success of any other individual contribution. Furthermore, each specialist makes his contribution either at the extreme ends of the habilitative process or somewhere in the long middle. Thus, any one doctor on this assembly line receives but a limited view of the total process. In resolving this problem we remembered that Aristotle once said, "He who sees things from their beginnings will have the most advantageous view of them." We modified this statement to read "Seeing things together from their beginnings will provide an advantageous view for all concerned."

It was at this point that the longitudinal growth study, originally separated and somewhat aloof from the service and training aspects of the Cleft Palate Center, assumed a special importance. The research group had been accumulating a library of records on each child since early infancy. The records included cephalometric roentgenograms, casts of the face and jaws, and photographs. The roentgenograms and casts were not only pictorially valuable but represented data that could be subjected to accurate quantification. This storehouse of information on each child meant that the group as a whole could visualize the progress of each child and examine the natural sequence of events from birth onward.

What were the practical results of this group experience in seeing these things together from their beginnings? First, it forced upon us the need for a language of clarity and common intelligibility by which we could describe to one another the anatomic and physiologic characteristics of the defect. Second, the multiplicity of variable elements observed at birth cleared the air of preconceived notions about any single mode of therapy and made room for

the prescription of treatment based on a synthesis of the morphologic and physiologic status of the individual child.[3]

Thus the first step in the intricate process of organizing a team had succeeded. A common language had been developed by means of which we could describe to each other the results of our individual clinical observations.

Ego Support Through Research.—In a large university, the team may recruit its personnel in several ways. Some are like Hessian soldiers, hired to do a job. Others gravitate toward the team because of some special motivation or interest in the team's enterprise. The majority of the academic staff members are appointed by the heads of their respective departments to fill a place in the table of organization that constitutes the team.

The assignment of a professional person to a post outside his own department is sometimes regarded as a banishment to an academic Siberia. For the sake of discussion, let us regard the case of a hypothetical young otorhinolaryngologist newly assigned to the Cleft Palate Center. As he takes his seat among us, he is introduced to a social worker, a speech pathologist and a public health nurse on his right and a prosthodontist, an orthodontist and a pedodontist on his left. Farther down the line he recognizes some of his medical colleagues, but one is a pediatrician and another a plastic surgeon; occasionally a psychiatrist is present. The poor fellow feels isolated and alien to this group.

When the patient is brought into the room, our colleague from the ear, nose and throat department is invited to examine the child and report the results at a staff conference that follows. During cross-discussion, he may be asked certain questions pertinent to his own field that he will be unable to answer. To illustrate, let us say that the otorhinolaryngologist recommended the removal of the tonsils and adenoids because of a recurrent history of infections of the middle ear and the upper part of the respiratory tract. The speech pathologist quickly points out that the adenoid contributes a static but important portion of the velopharyngeal valve and that its removal would destroy the effectiveness of that mechanism. Faced with the problem of resolving these conflicting views, the medical specialist may recognize the limitations of his own information and experience. Moreover, he realizes that no one else in his special field has the answers to the problems that he now faces all alone.

This is a moment of crisis in this person's career on the team. The bright "eager beaver" will realize that he is on the front line of discovery. If he takes up arms and does battle with the unknown, he will contribute to his own and to the team's success. If not, he will prove a dud.

As each man undertakes to solve his own particular problem and succeeds, he proves his value in two separate ways. First, he gains the respect of his teammates and his contribution testifies to his importance to the team. Second, and perhaps even more important to the person concerned, the significance of his accomplishments is recognized by others within his own specialty. As I shall point out later on, this evidence of the individual member's growth reflects favorably upon the team and contributes toward its further development.

On Doing Things Together. — To a greater or less degree, there are certain stereotyped concepts held by one profession about the others that tend to prejudice and hinder communication between them. While it is not within the province of this paper to deal with the roots of such biased views, it is within its scope as a matter of concern. How can deeply entrenched attitudes be altered, and how can

the efforts of seemingly opposite camps be bound together in common purpose? To illustrate, I have borrowed one example out of many similar experiences:

Shortly after our team was organized, we were called in consultation by the department of pediatrics to advise on the case of an infant with the Pierre Robin Syndrome.[4] This syndrome consists of hypoplasia of the mandible, cleft palate, glossoptosis, inspiratory retraction of the sternum, cyanosis and malnutrition. The fatal termination in many such cases attest to the severity of this syndrome.

It was clearly evident that all of the pathophysiologic events in the syndrome were related to the recessive chin, which failed to support the tongue in its normal forward position within the oral cavity. Therefore, our attention was focused upon the growth of the mandible. First, we wished to know what was the potential for growth of the micrognathic mandible and at what rate that potential would be expressed in early infancy so as to accommodate the tongue and insure an adequate airway. Second, would mandibular growth be sufficiently sustained to provide an esthetically satisfactory facial profile in later life?

Utilizing the research resources available to us, an investigation along these lines was incorporated in our longitudinal growth studies. A preliminary report of these studies was published recently, in which we were able to provide the answers to the two questions which motivated this particular aspect of our research.[5] It was found that when an adequate metabolic climate was provided and the infant gained in weight, mandibular growth during the first few months was sufficient to provide for a natural resolution of the symptoms related to the glossoptosis.

Since the cephalometric films accurately assessed the degree of glossoptosis and the amount of occlusion of the airway, it became possible to develop a rationale for therapy, tracheotomy being utilized in extreme situations and more conservative measures selected for less severe conditions. The serial cephalometric films also indicated that mandibular growth was proportionately adequate to minimize the original retrognathic profile and improve the appearance of the face.

Solving this problem was a group experience, and therein could be found an important ingredient for the success of the team's enterprise. Here was a problem recognized and defined by a pediatrician, solved by an orthodontist utilizing tools developed in orthodontic research, and the results applied by a surgeon. Thus a program of intramural research involving as many persons as possible offered a vital cementing influence that came of doing things together, each according to his special knowledge and ability and each in a dignified relation to the other.

One Foot In, One Foot Out.—One of our people confided that he was increasingly disturbed by the fact that he was becoming identified as a cleft palate specialist. To be sure, this concern was shared by others who did not wish to be labeled as cleft palate orthodontists, cleft palate pediatricians, and so on. Our interests, even though limited by our specialistic identifications, were far wider. In common with movie stars, we resented being "typed." While we retained one foot in the Cleft Palate Center, it was still necessary to support the other foot, which was situated on a broader base within our individual professions. This was not only a problem for the individual member; it also threatened the future of the team. Here again, our research program seemed to solve the problem.

It was once said that if doctors came to know syphilis in all of its clinical manifestations, all things in medicine would be rendered unto them. In a more limited

sense, this was also true of cleft lip and palate. All of us agreed that we had become better physicians, dentists and speech pathologists because of this experience and that the knowledge gained transcended its application within the narrow confines of the cleft palate program.

Perhaps the greatest compliment to our efforts came from persons outside of the group who had no real interest in the cleft palate program. Word had spread that there was something unique in our way of caring for the child with a handicap, that we had developed a special kind of knowledge and new tools, and that answers were being found for previously unsolved problems. As a result, neurosurgeons and neurologists began to direct children with congenital anomalies of the cranial vault to our center for growth studies. Children with speech problems unrelated to cleft palate were referred to our clinic because the required integrated services of speech pathology, medicine and dentistry were not available elsewhere.

In time the special knowledge, the tools, and the way of working together developed at the Cleft Palate Center were called to contribute in many different areas. Thus membership in the team did not imply restricted utilization of individual talents, but rather enlarged and diversified application of professional abilities.

I have already described a crisis in an individual member's relation to the team. This particular phase in the group's development was a critical point for the team as a whole. Teams bog down and interest wanes even under optimal conditions, and staff conferences come to sound like the repetitive noises of a broken record. Our vulnerability was analagous to that of a manufacturer who produces a single product. As in industry, we found security and intellectual prosperity in diversification rather than in contraction of interest.

Whither the Team?—There have been objections that the team organization is not an economical way of doing business; that it is difficult if not impossible to bring together busy practitioners at a fixed time; that it is not a practical way of doing business and can succeed only in the protected environment of a university; that such meetings result in much talk and little action, and that the talk tends to be repetitive and does not contribute to the enlargement of anyone's views. It must be admitted that these arguments possess a large measure of validity and therefore merit discussion.

The team idea has become something of a bandwagon, and many have climbed aboard without realizing that they must contribute to its mobility. As soon as the procession stalls, there is a tendency to hop off and blame it on the bandwagon. The defect is not in the idea of the team, but rather in the unskilled use of the idea. When the members do not know how to communicate or through lack of information have nothing to communicate, then the team idea will fail. It matters not how many ball players you have or who is captain of your team. What does matter is a nucleus of skillful and specialized talents willing to learn to play together.

Where does the team approach fit into private practice? Obviously it is not economical to arrange for many busy practitioners to be present at the examination of each patient. The concept of the multidiscipline approach requires not so much physical proximity among specialists as intellectual perception of one another's abilities and difficulties in dealing with a given clinical problem. Thus professional persons who have served on a team such as ours become self-sufficient persons, quite secure in their own ability to plan for the patient and capable of communicating effectively with other specialists in their communities. This does not imply that the orthodontist offers surgical judg-

ments or that the pediatrician prescribes a plan of speech therapy. On the other hand, each practitioner develops a knowledge of the proper sequence of therapeutic events and of the possibilities and limitations of other forms of therapy. Above all, he knows when to seek advice and from whom.

The future of the team is not that of a new medium for the practice of the health sciences on a broad scale. As a consultative or diagnostic agency its value cannot be denied. But far more significant, if one takes the long view, is the team's value as a medium for the education of professional personnel at both the undergraduate and the postgraduate level. No other agency exists within the university framework that is as capable of conveying the "total patient" concept in therapy as is the multiprofessional team. Therein lies its greatest value.

SUMMARY

The increasing concern for the complex and many-faceted needs of the child with a cleft lip and palate had brought about the organization of teams consisting of various specialists in the health sciences. The organization of diverse professional talents and personalities into a working and effective unit, however, implies a great deal more than bringing together several persons to examine the same patient at the same time. It involves a slow and sometimes painful process of learning to communicate, of overcoming semantic and emotional barriers.

It was the experience of a group of professional persons at the Cleft Palate Center of the University of Illinois that a program of basic research designed to support the educative processes of the team, as well as provide information of therapeutic value, provided an important catalyst in unifying the separate efforts of many persons. By seeing things together from their beginnings, every member of the team experienced an enlargement of his own perspective and observed the relation of his efforts to those of others serving the same patient. The involvement of medical and dental specialists, speech pathologists, social workers and public health nurses in joint research projects was not only supportive to each specialist's role on the team but served to dissolve the barriers prejudicial to proper communication among the several specialties.

The experience of this group in the environment of a large university suggests the value of the team approach as an instrument in the education of undergraduates and postgraduates in medicine, dentistry and the auxiliary professions. Improved care of patients will result from such educative processes.

ZUSAMMENFASSUNG

Das wachsende Interesse an den komplizierten und vielseitigen Bedürfnissen von Kindern mit Hasenscharten und Wolfsrachen hat zur Bildung von Arbeitsgruppen von Fachleuten aus verschiedenen Gebieten der medizinischen Wissenschaft geführt. Die Gestaltung einer Gruppe von verschiedenen Spezialisten und Persönlichkeiten zu einer erfolgreich funktionierenden Einheit erfordert allerdings erheblich mehr als das Zusammenscharen einer Anzahl von Personen, die denselben Patienten zur gleichen Zeit untersuchen. Dazu gehört die langsame und oft schwierige Erlernung der Verständigung mit dem Kranken und die Überwindung von Hindernissen, die durch sprachtechnische und seelische Schwierigkeiten gebildet werden.

Die Wolfsrachenzentrale der Universität von Illinois, die aus einer Gruppe von fachkundigen Personen besteht, hat die Erfahrung gemacht, dass zur Vereinigung

und Gleichrichtung verschiedenartiger Bestrebungen mehrer Personen ein Arbeitsprogramm für die grundlegende Forschung eine grosse Hilfe ist. Ein solches Programm muss zum Ziele haben, die erzieherische Arbeit der Gruppe zu unterstützen und Erfahrungen, die von therapeutischem Wert sein könnten, zur Verfügung zu stellen. Durch die gemeinsame Betrachtung der Dinge von ihren Anfängen an gelang es jedem einzelnen Mitglied der Gruppe en eigenen Gesichtswinkel zu erweitern und die Beziehungen der eigenen Bemühungen zu denen der anderen am gleichen Patienten Arbeitenden zu beobachten. Die Teilnahme von Fachärzten, Zahnärzten, Sprachstörungsspezialisten, Sozialarbeitern und Krankenpflegern des öffentlichen Gesundheitswesens an geminsamer Forschungsarbeit trug nicht nur zur Föderung der eigenen Bemühungen des einzelnen Facharbeiters der Gruppe bei, sondern half auch, die Schwierigkeiten zu überwinden, die einem Meinungsaustausch zwischen den verschiedenen Fachgruppen im Wege stehen.

Die Erfahrungen dieser Gruppe im Milieu einer grossen Universität weisen darauf hin, dass die Gruppenarbeit sich auch in der Erziehung von Medizinern, Zahnärzten und Angehörigen der Hilfswissenschaften vor und nach dem professionellen Abschlussexamen als ein wertvolles Unterrichtsmittel erweisen könnte. Derartige Erziehungsmethoden werden eine Verbesserung der Krankenversorgung zur Folge haben.

RESUMEN

La creciente complejidad de las muy diversas necesidades del niño con labio leporino y paladar hendido, ha traído la creacion de equipos de varios especialistas en las ciencias médicas; la organización de diversos talentos y personalidades médicas en una unidad trabajadora y efectiva. Sin embargo, es much más complejo el examinar al mismo paciente en una misma ocasión por un grupo de personas. Comprende un proceso lento y algunas veces doloroso de aprendizaje para comunicar y sobreponer barreras emocionales. Ha sido la experiencia de un grupo de profesionistas del centro para paladar hendido de la Universidad de Illinois, se ha diseñado un programa de investigación básica para proporcionar el proceso educativo del equipo; así como para suministrar información de valor terapéutico, teniendo en cuenta la importancia fatalista de unificar los esfuerzos separados de muchas personas. Juntando las cosas desde un principio, cada miembro del equipo experimenta un aumento de sus propias perspectivas y observa la relación de su esfuerzo con aquel de otros que atienden al mismo paciente. La unión de especialistas médicos y dentales, patólógos del lenguaje, trabajadores sociales y enfermeras, para la investigación, no únicamente apoya el papel de cada especialista, sino que sirve para disolver los prejuicios para la comunicación apropiada entre distintas especialdades.

La experiencia de este equipo en el medio de una gran Universidad sugiere el valor del equipo como un instrumento para la educación médica y postgraduada, odontológica y de profesiones anexas. El mejoramiento del cuidado de los pacientes resulta de tal proceso educativo.

RÉSUMÉ

L'intérêt croissant pour les exigeances complexes et à plusieurs aspects de la gueule de loup de l'enfant a amené l'organisation d'équipes constituées par différents spécialistes des sciences de la santé. L'organisation de la réunion de divers talents et personnalités professionnelles dans une unité de travail efficiente, implique beaucoup plus que de rassembler plusieurs personnes pour examiner le

même patient en même temps. C'est un processus lent, parfois pénible, consistant à apprendre à communiquer, à surmonter la sémantique et les barrières émotionnelles.

Ce fut l'expérience d'un groupe de professionnels au Centre du Palatoschizis de l'Université de l'Illinois où un programme de recherches fondamentales, projeté pour l'éducation de l'équipe et aussi pour fournir des renseignements pour la thérapeutique, a catalysé, en les unifiant, les efforts séparés de plusieurs personnes. En voyant les choses dans leur ensemble à partir du début, chaque membre de l'équipe fit l'expérience d'un élargissement de sa propre perspective et observa la corrélation de ses efforts à ceux des autres au service du même patient. La réunion de spécialistes médicaux et dentaires, de spécialistes de la pforation, d'assistants sociaux et infirmières de santé publique dans les projets de recherches en commun, fut non seulement un appui an role dc chaque specialiste dans l'équipe, mais servit à faire fondre les barrières préjudiciables aux relations appropriées entre les différentes spécialités.

L'expérience de ce groupe dans les environs d'une grande université suggère la valeur de l'essai d'équipe comme instrument d'éducation des étudiants et assistants en médecine, médecine dentaire et professions auxiliaires. Un tel processus éducatif aboutira, pour les patients, à des soins perfectionnés.

RIASSUNTO

L'aumentato interesse verso i problemi posti dal labbro leporino e dalla palatoschisi ha portato alla constituzione di gruppi di vari medici specialisti, la cui organizzazione, peraltro, implica compiti ben più gravi di quello consistente nel portare più persone a visitare, assieme e nello stesso luogo, lo stesso paziente.

Fu questa l'esperienza di un gruppo di professionisti appartenenti al Cleft Palate Center dell'Università dell-Illinois. Studiando assieme le cose fin dall'inizio, ogni professionista del gruppo potè allargare il suo personale punto di vista e vedere quali relazioni avesseri i suoi sforzi con quelli degli altri colleghi occupati, con lui, nello studio e nella cura del medesimo paziente. L'interesse congiunto di medici, odontoiatri, specialisti del linguaggio, assistenti sociali, infermiere, fu non solo utile ad ognuno di essi ma valse a dissipare molti pregiudizi, facilitando cosí una più pronta collaborazione fra tutte quelle diverse attivita specializzate.

L'esperienza di tale gruppo nell'ambito di una grande Università dimostra il valore didattico di un tale tipo di organizzazione nell'insegmamento a laureandi e laureati in medicina, odontoiatria e professioni ausiliarie. Il che, in definitiva, andrà poi a beneficio dei malati, dato il miglioramento delle cure che ne deriverà.

SUMARIO

O interêsse crescente com relação às necessidades múltiplas e complexas de uma criança com lábio leporino e fissura palatina acarretou a organização de equipes abrangendo vários especialistas. A união de vários indivíduos profissionalmente habilitados num grupo efetivo de trabalho implica, contudo muito mais do que o agrupamento de pessôas para examinar concomitantemente o mesmo paciente. Implica num processo lento e às vêzes penoso para aprender a comunicar e vencer barreiras emocionais e semânticas.

A experiência de um grupo de profissionais no Centro de Lábio Leporino da Universidade de Illinois, demonstrou que um programa de pesquizas básicas destinado a apoiar os processos educacionais da equipe, bem como fornecer informações de valôr terapêutico, representava impor-

tante papel na unificação dos esforços distintos de muitas pessôas. Vendo os fatos concomitantemente, desde seu inicio, cada membro da equipe experimentava um aumento de sua própria perspectiva e observava a relação de seus esforços com os de outros que atendiam o mesmo paciente.

A utilização de especialistas médicos, odontológicos, patologistas de fala, educadores sociais e enfermeiras de saúde pública em planos de pesquiza conjunta não só dava apôio ao papel de cada especialista na equipe como servia também para desfazer as barreiras prejudiciais à comunicação adequada entre as diferentes especialidades.

A experiência dêste grupo num grande meio universitário sugere o valor da equipe como instrumentos na educação de elementos já formados ou não na medicina, odontologie e profissões auxiliares. De tais processos educacionais resultará melhor cuidado dos pacientes.

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Whenever a daring genius has the courage to advance a new thought, he is usually first ridiculed, then either banished or persecuted, if not prosecuted, and declared "an enemy of the people." If he still succeeds in disentangling himself, and is endowed with super-human fortitude, and continues his fight to reveal the truth for the benefit of mankind—his work is then belittled or merely "criticised." If his adversaries by then have still failed to silence him, they try to usurp the advantages derived from his new idea while constantly blaming the daring protagonist for the slightest failure directly or indirectly connected with his work.

If and when such a mortal is fortunate enough during the short span of his life to overcome all these human weaknesses and wickedness, he is then finally proclaimed a benefactor of the human race and crowned with success. But history shows that in most of these cases the great standard bearers of truth are fully recognized only a long time after the worms have had ample chance to devour the last vestige of the martyred supermen in their graves. It is then that monuments are erected to immortalize their memories.

—*Johns*

Editorial

A Glimpse of the History of Urology in Egypt

SCHISTOSOMIASIS is one of the major medical problems of Egypt and has been since the time of the Pharaohs. Evidence of this was found by Dr. Ruffer, a physician and Egyptologist, who discovered bilharzia ova in the wall of the right ureter of a Twelfth Dynasty mummy. Symptoms of bilharziasis are also described in the famous Ebers Papyrus, written four thousand years ago. The disease that produces so many urologic complications must have been dealt with by physicians at that time, but the details of their treatment and procedure are lacking.

After the disintegration of the Egyptian Kingdom, various foreign influences were brought to bear on the development of Egyptian medicine. Its history can therefore be divided into the Greco-Roman, the Arab and the Modern periods.

The Greco-Roman period was rich in contributions to the field of urology after the conquest of Egypt by Alexander the Great and the subsequent introduction of Greek methods.

In 525 B.C. a medical school was founded in Sais in Lower Egypt. Medicine was already divided into specialties, among which was urology. Erasistratus laid stress on the importance of examination of the urine and was the inventor of the S shaped catheter. Ammonios introduced the lithotrite, and Rufus of Ephesus was the first to describe the prostate and the vas deferens. He also gave an account of pyuria, prostatic abscess and retention of urine. He treated the last mentioned condition by catheterization, sitz baths and hot fomentations. An interesting description of vesical hemorrhage and resulting shock was also written by Rufus. The treatment of shock included bandaging of the extremities, as is sometimes done today. The pathologic picture and the symptoms of calculi in the urinary bladder are described in great detail, including the technic of perineal urethrotomy.

Another great physician, Areteus of Cappadocius, who lived in the beginning of the Christian era, was the first to describe the effect on urine secretion of a calculus arrested in the ureter. He also attributed the susceptibility of the bladder to infection to its proximity to the rectum in the males and the uterus in the female.

Galen was the last of the great physicians of antiquity. He demonstrated that ureters convey urine and not spermatic fluid to the bladder. This he did by tying the ureter of a dog and showing that the urine stopped flowing into the bladder and, instead, distended the ureters above the point of ligation. He also showed the frequent occurrence of vesical calculi in boys, which may indicate that Bilharziasis was, at the time, an important etiologic factor in the production of stones.

The greatest physician of the Hellenic period was Alexander of Tralles. He wrote a treatise on medicine in twelve volumes, the eleventh of which is devoted to diseases of the urogenital system. He emphasized the importance of finding pus thoroughly mixed with the urine, before making a diagnosis of pyelonephritis, in

contradistinction to pus excreted separately from the bladder at the beginning of micturition, before making a diagnosis of pyelonephritis.

Paul of Aegina, the last of the Greek physicians and known to the Arabs as "the obstetrician," described various plastic procedures for the treatment of phimosis, paraphimosis, hypospadius and adhesions of the prepuce. He also gave an account of the technic of catheterization. In discussing castration, he recommended excision and not crushing of the testicles, as he had noted that sexual power was sometimes retained after the latter procedure. He recommended heat cauterization of the sac in the treatment of hydrocele.

From the death of Galen to the Arabian conquest, medicine slowly degenerated as mysticism and superstition undermined the scientific spirit. Not until the ninth century, did Arab medicine emerge as a true science, under the protection of Abbassyde Calíphs, who encouraged the translation of scientific Greek manuscripts.

An original contribution was made in the year 850 by Ali Ibn Cabban el Tabbari. In his book *Paradise of Wisdom* he attributed incontinence of urine to relaxation of either the sphincter or the bladder, or to cystitis. He also mentioned oligospermia and aspermia.

A Persian physician, Mohammed Ibn Zakariah el Razi (863-925), wrote a long treatise full of annotated descriptions of cases that reveal him as a clinician of unusual keenness.

Rhazes recommended perineal urethrotomy and catheterization to relieve obstructions of the vesical neck. He also dealt in great detail with the problem of urinary calculi.

In the second half of the tenth century, Abul Kassem Khalaf el Zahrawi, known in Western literature as Abulcasis, published in one of his numerous books a detailed and original description of the surgical treatment of urethral calculi. He used a pointed instrument or a wire fitted with a diamond at its tip to pierce and pulverize the calculus with a rotary movement. He discussed the accidents incidental to lithotomy.

Another prominent physician, Ali Ibn Abbas, in his *Complete Book of Medical Art*, offers a comparative description of the anatomic and physiologic aspects of the male and female genital organs. It was his opinion that erection was produced by distention of the penile cavity with air.

One of the most famous Arab physicians was Ali el Hosein Ibn Sina. In his voluminous book *The Canon of Medicine* a section was devoted to urology, in which he dealt in great detail with the manufacture of catheters and the art of catheterization. He described the symptoms of vesical hemorrhage and listed a series of measures for its control. He advocated the use of astringent medication, the heat cautery and ligation of blood vessels, depending on the extent of the bleeding. Removal of clots, he stated, should be done with a finger introduced into the bladder through a perineal urethrotomy.

Mohadhab ad Din Ali Ibn Habal, who lived in the twelfth century, recommended a low fluid intake after cystotomy to decrease leakage of urine and facilitate wound healing.

A number of interesting observations covering the period from 1580 to 1583 are contained in the *Memoirs* of Prosper Alpin, physician to the consul of Venice in Egypt. He recorded the frequency of renal calculi, which he attributed to sexual excesses and impurities in water. He described an ingenious "nonsurgical" method for extraction of vesical calculi. A wooden tube was introduced into the urethra, and an assistant manipulated the stone with a finger in the rectum and pushed it toward the vesical neck. The surgeon then sud-

denly withdrew the tube, and with it the stone.

Interestingly, nowhere does one find mention of gonorrheal urethritis, although descriptions of its common complications, orchitis, epidydimytis and cystitis, are extant. The first mention of syphilis was made in the sixteenth century by Daoud al Antaki, chief physician of Egypt. At that time the country was passing through a period of intellectual and political decadence, having become a Turkish province exploited by the Pashas and the Mameluks —a state of things that lasted over two hundred years.

The Modern Period of Egyptian medicine began with Bonaparte's campaign in Egypt (1798-1802). Little mention of urologic disease is to be found in the report of his army physicians, who were more concerned with dysentery and other epidemic diseases.

In 1827 Mohammed Ali the Great created a medical school in Cairo and invited German and French scientists to make up the staff. Pruner, a Bavarian anatomist and surgeon, was the first to perform autopsies and to observe bilharzial lesions of the bladder and ureter. He also noted the frequency of gonorrheal urethritis. He made no mention of prostatic hypertrophy.

In 1850 Theodore Bilharz came to the medical school now established in Kasr el Aini Palace in Cairo, the present seat of Fouad First University Medical School and Hospitals. In his first two years this young German internist and zoologist performed more than 400 autopsies. His aim was to study intestinal parasites. He soon reported his discovery of the worm Distomum haematobium in the branches of the portal vein. The parasite was later called Bilharzia haematobium, thus immortalizing the name of this great scientist.

He attributed the extreme frequency of calculi in the bladder and ureters to the presence of the parasite, as he detected bilharzia ova in the center of the calculi. His work laid the foundation for the eradication of what r e m a i n s the g r e a t e s t scourge of the Egyptian peasantry.

It is impossible in this short review to do justice to all the great men who have contributed to our present knowledge of urology. This brief account may give us some insight into their courage and determination in the treatment of the sick and their ingenuity in developing methods in spite of technical limitations.

A. BITSCHAI, M.D., F.I.C.S.
Alexandria, Egypt.

When a man has equipped himself by thought and study for a bigger job, it usually happens that promotion comes along even before it is expected.

—Winnett

The difference between one man and another is not mere ability—it is energy.

—Arnold

New Books

Books Received.—The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however, is not to be taken as criticism of the merit of the book.

Legal Medicine, Pathology and Toxicology. By Thomas A. Gonzales, Morgan Vance, Milton Helpern, and Charles J. Umberger. 2nd ed. New York, Appleton-Century-Crofts, Inc., 1954. Pp. 1349. Profusely illustrated.

Les Vomissements du Nourisson: Etude critique, Diagnostic ètiologique, Indications thérapeutiques. Par Emilio Roviralta. Edition revue et augmentèe par l'auteur en 1952. Adaptation frañçaise de Bernard Duhamel, d'après la traduction de Edouard Del Castillo Japuolot. Paris, Èditions Médicales Flammarion, 1952. Pp. 236. Illus.

Technique de la Chirurgie du Sympathique et de ses Infiltrations. Par O. Lambret, P. Razemon, et P. Decoulx. 4e èd. Paris, G. Doin & Cie, 1953. 115 figures et 4 planches.

Cystites Invétérées et Algies Pelviennes, leur Traitement par Infiltrations Anesthésiques et Neurotomies Chirurgicales. Par Raymond Darget et Rolland Ballanger. Paris, Masson & Cie, 1954. Pp. 118. Illus.

El Dranaje en Cirugía. Por Domingo Prat. Montevideo, Imprenta Rosgal, 1954. Pp. 166. Illus.

Aspectos Quirurgicos de la Estasis Biliar. Por J. Pi-Figueras, con V. Artigas y A. Llauradó. Madrid, Asociación Española de Cirujanos, n.d. Pp. 155. Illus. (III Congreso Nacional de Cirugía, Granada, Septiembre de 1953).

La Aortografía Abdominal. Por Ramon Carillo, Raul F. Metera, y Juan de Dulácska. Buenos Aires, Lopez & Etchogoyen, S.R.L., 1954. Pp. 114. Illus.

Harofe Haivri, the Hebrew Medical Journal (New York), Vol. I, 1954. Pp. 256.

Sindromi Dolorose dopo Interventi Gastrici e loro Terapia Chirurgica. Per Luigi Leopoldo Bracca. Torino, Minerva Medica, 1952. Pp. 178. Plates.

Thorakoskopische Eingriffe am Nervensystem. Von E. Kux. Stuttgart, Georg Thieme, 1954. Pp. 130. 48 Teils mehrfarbigen Abbildungen.

Pheochromocytoma and the General Practitioner. By Joseph L. DeCourcy and Cornelius B. DeCourcy. Cincinnati, DeCourcy Clinic, 1952. Pp. 165.

Pratique de L'intubation intra-trachéale en Anesthésie. Par Henri Gibert. Paris, G. Doin & Cie, 1953. Pp. 188. 39 figures.

The Year Book of Obstetrics and Gynecology, 1954-1955. Ed. by J. P. Greenhill. Chicago, Year Book Publishers, 1954. Pp. 544. Abstracts.

Anuario Bibliografico Peruano de 1949-1950. Ed. by Alberto Tauro. Lima, Biblioteca Nacional, 1954. Pp. 427. (Ediciones de la Biblioteca Nacional-IX.)

A general bibliography. I. Books and pamphlets. II. Periodicals. III. Bio-bibliographies. IV. Bib. of librarianship. Fully indexed, with cumulative contents of the series.

Part I contains a section on medical sciences.

Hugh Roy Cullen, a story of American Opportunity. By Ed Kilman and Theon Wright. New York, Prentice-Hall, 1954. Pp. 376. Illus. Biography of a distinguished medical benefactor.

Diseases of the Skin, for Practitioners and Students. By George Clinton Andrews. 4th ed. Phil. and London, W. B. Saunders Co., 1954. Pp. 877. 777 illus.

La Valvola Mitrale: Aspetti anatomici, fisiologici, clinici e chirurgici. Per Michele A. Chiechi e Charles P. Pailey (sic). Roma, Pensiero Scientifico Ed., 1954. Pp. 561. Illus.

The History of the Samaritan Free Hospital, with an Appendix on the London Hospitals and infirmaries. By Arnold Whitaker Oxford. Cambridge, W. Heffer & Sons, Ltd., 1931. Pp. 96.

Patología del Estomago Operado: II Congreso Argentino de Gastroentoerología, Mar del Plata, 13-18 de Abril de 1953. Contributors from Sociedad de Gastroenterología de Buenos Aires, Asociación Argentina de Radiología, and Sociedad Médica de Mendoza. Buenos Aires, Ed. Universitaria, 1954. Pp. 482. Illus.

Verhandlungen der Deutschen Gesellschaft für Chirurgie, 70 Tagung, 7-11 April 1953. Berlin, Springer Verlag, 1953. Pp. 768. Illus. (Langenbecks Archiv für Klinische Chirurgie, Band 276.)

The Antiseptic (Madras), Golden Jubilee Number, April, 1954. Pp. 233-732.

BOOKS REVIEWED

Splenoportographie. By Lucien Leger. Paris: C. Doin et Cie, 1955.

This welcome book, amply illustrated, is a most valuable contribution to our knowledge of the normal and pathologic circulation of the blood and of the relation of its disturbances to the supermesocolic organs. It elucidates, explains and guides in the treatment of certain splenomegalies. It cites many cases in which compression or thrombosis of the splenic vein is secondary to pancreatic lesions and clinically demonstrates how neoplastic, parasitic, and inflammatory lesions of the liver influence the morphologic character and the circulation of the splenoportal axis.

It demonstrates that splenoportographic study is of great value to the surgeon in determining the operability of certain pancreatic tumors. Splenoportography enables the surgeon to avoid lobar hepatectomy in cases of silent metastases. It also enables him in suitable cases to perform a lobar hepatectomy. It simplifies and instructs the clinician as to the splenoportographic technic. It discusses incidents and accidents of the method, normal splenoportographic data, splenic and hepatic observations and the results of splenoportographic study.

For outlining the spleen the dorsal position is the most comfortable. In the voluminous spleen the puncture is easy, be it subcostal, lateral, anterior or transparietothoracic. Local subcutaneous anesthesia is helpful. As injection material the author uses *diodone*. The splenic and hepatic circulation, normal or abnormal, is outlined splenoportographically. The technic is easy. The results are illustrated by eighty well-chosen illustrations. Each picture represents an individual case. The method is most valuable from the diagnostic and therapeutic standpoints and has shown its value and accuracy in detecting obstacles to the circulation of the splenic and portal veins, caused by a thrombus or compression by surrounding tumors, benign or malignant, or by abnormalities of the vessel walls. Chapters are devoted to the value of the splenoportographic in the influence of splenomegaly, to cirrhosis of the liver, etc.

The method also gives valuable information as to the extent and location of pancreatic lesions, hepatic metastases and to various affections of the liver, hydatid cysts, abscess of the liver or tumor. It has proved valuable in determining the cause of some gastric hemorrhages associated with icterus and of unexplained painful syndromes.

This book deserves a place on every physician's and surgeon's desk.

AIMEE PAUL HEINECK, M.D.

Die Chirurgie der Peripheren Nerven. By Dr. Henry Nigst, with an introduction by Prof. Rudolf Nissen. Stuttgart; Georg Thieme, Publisher. 1955. Pp. 196, with 104 illustrations.

This monograph which deals with the diagnosis, surgical treatment and after-care of lesions of the peripheral nerves, is a valuable contribution to an often neglected branch of neurosurgery.

New laboratory methods such as determination of the intensity duration curve and electromyographic procedures are discussed, and the recent clinical experiences with peripheral war casualties are utilized.

A precise and detailed description of the operative technic in surgical treatment of the different nerves, supported by excellent illustrations, enables the nonspecialist to perform the procedure in a step-by-step fashion. An interesting historical review and an extensive bibliography enhance the value of the book.

ERNST HAASE, M.D.

Obstetrics. By J. P. Greenhill. Philadelphia: The W. B. Saunders Company, 1955. 11th ed. Pp. 1002, with 1170 illustrations.

The new eleventh edition of Dr. Greenhill's *Obstetrics* has been thoroughly and completely revised. The contents of Part I and Part II deal with the physiologic, pathologic and practical aspects of operative obstetrics, respectively. The subject matter has been clearly defined and systematically presented.

There are several new chapters: *Endocrine Changes and Diseases During Pregnancy; Roentgenology in Obstetrics; Analgesia and Anesthesia; Fetal Erythroblastosis and the Rh Factor; Induction of Labor; Prolonged Labor,* and *Diseases of the Nervous System.* Many new data have been added on the physiologic nature of the fetus and the newborn, the physiologic character of the uterus, the toxemias of pregnancy, abruptio placentae and, especially, the severe hemorrhages associated with insufficiency of fibrinogen. Acute infectious diseases in pregnancy, pulmonary tuberculosis, diseases of the blood, choriocarcinoma, the lower nephron syndrome, renal diseases, puerperal infection, asphyxia, pulmonary hyaline membranes, retrolental fibroplasia and cerebral palsy are treated.

To make the book as accurate and authoritative as possible, Dr. Greenhill secured the assistance of specialists in various branches of medicine. He removed many old illustrations and added 125 new ones. The book now contains 1,170 illustration, of which 144 are in color. This is a most important part of the book. Furthermore, the drawings and photographs are excellent. The section dealing with operative obstetrics beautifully and very vividly illustrates to the student or teacher the fundamental modern operative technics. The illustrations of each surgical step are superb, demonstrating the performance and repair of episiotomies and the application of forceps under varying conditions. It also shows the technic of low cervical cesarean section (laparotrachelotomy), in the use of which the author was a pioneer; low transverse cervical section; extraperitoneal section, and cesarean hysterectomy. This section alone, incorporated in such a text, is virtually an atlas, profusely illustrated with operative obstetric technics.

It is amazing how much useful information is packed into this volume. Throughout the book there is evidence that Dr. Greenhill is an outstanding obstetrician, a teacher, a writer and the possessor of an almost fantastic knowledge of obstetrics. The book is written in simple, clear language, which students as well as practicing physicians can easily understand. Dr. Greenhill possesses the gift of being able to select from the vast literature on obstetrics the really worthwhile contributions. He indicates what is right and what is wrong, what is useful and what should be given up as antiquated and useless. That the book is really up to date is shown by the fact that there are references to articles that appeared in the literature as recently as April 1955.

This book is really an obstetrical classic. It is a "must" in every obstetrician's library and every obstetricial division.

HARRY O. MARYAN, M.D.

Segmental Anatomy of the Lungs. By Edward A. Boyden. New York: Blakiston Division, McGraw-Hill Book Company, 1955. Pp. 276, with 137 illustrations.

Every thoracic surgeon will find this book an asset. It is the result of nine years of persistent effort and thorough study by the author, a distinguished anatomist, and his team of co-workers. Unquestionably this treatise will be recognized for years to come as the definitive work on the patterns of segmental bronchi and the corresponding pulmonary vessels. It stands as a classic contribution in its first edition and supplies all the pertinent anatomic information related to segmental pneumonectomy. Valuable surgical criteria are presented, and possible pitfalls are emphasized as they pertain to maximal conservation of respiratory tissues.

As the author states, the volume is primarily an anatomic treatise, although clinically oriented. Differences in the resectability of pulmonary segments are emphasized throughout, and it is further shown that, in the presence of anomalous conditions of some segmental arteries, resection of a segment may jeopardize the blood supply of an adjacent segment.

The volume is excellently organized, scholarly and original. The illustrations, many in color, are of high quality and most instructive. The ten chapters deal, successively, with a historical review of pulmonary anatomy; general aspects of the bronchial tree; prevailing terminologies; the anatomic aspect of each lobe, with separate and detailed consideration of the bronchial, arterial and venous distribution; the hilar portions of the interlobar fissures; the development of the lungs and the formation of congenital anom-

alies, and, finally, the lungs in general.

The historical review clarifies a difficult subject. The "doctrine of the stem bronchus" is particularly discussed and all pertinent pioneer work carefully considered. The author points to the need for better information on lymphatic drainage and the innervation of the segments—the only gross anatomic espects not considered in this volume. He indicates the most promising methods for bronchographic identification of variations in the principal subsegmental bronchi.

The problem of establishing an adequate and generally acceptable nomenclature for segmental and subsegmental bronchi is closely related to the extreme variability of the lungs. Dr. Boyden's main effort, therefore, was to find the prevailing patterns and to analyze the numerous variations. The clue to the latter lies in the variable origin of the bronchi supplying a given zone. Most variations reside in the displacement of subsegmental bronchi. Lungs consisting entirely of the prevailing patterns are rarely encountered. Since the developmental process is an integrated one, it must be recognized that "variations in one direction produce compensations in another and that each specimen attains a symmetry and a character of its own." The solution to the problem of finding "normal" or prevailing patterns of bronchial and vascular distribution, therefore, lay in numbers and in statistical analysis of the extensive material. From the almost bewildering diversity of lung structure the Minnesota team of anatomists and surgeons established the patterns on the basis of experience, having injected and dissected as many as 50 to 100 individual lobes. Even so, the given percentages for the frequency of a particular pattern show considerable variation. Such percentages,obviously, are highly relative.

For the purpose of clarification and instruction, a hypothetical pair of lungs was designed in which the prevailing patterns of all the principal bronchi were combined. The names and numbers attached to these segmental bronchi are identical with those adopted by Jackson and Huber. Boyden's nomenclature differs in only one respect: he designates the two branches of the anterior-basal bronchus as true segmental bronchi but considers this discrepancy relatively unimportant. In Boyden's terminology, for the first time, corresponding bronchi, arteries and veins are given an identical enumerative designation, which is a most clarifying feature. Subsegmental bronchi and their corresponding vessels, likewise, are identified in a definite order from above downward. A sort of "medical shorthand" was thus developed for the enumeration of segments and subsegments. It is logical and clear. One may justifiably hope that this system of naming the basic structural components of the lungs will be internationally accepted.

The volume contains a critique of an international nomenclature accepted by the Congress of Otolaryngology in London in 1949. This critique was previosuly published and appears to be based on valid anatomic facts. Dr. Boyden suggests that the Jackson-Huber terminology be retained until an official international committee can settle the matter.

The bulk of the volume, Chapters 3 to 8, contains unsurpassed anatomic descriptions of the lobes and their subdivisions. Therein lies the richest source of information for surgeons facing "lung problems."

Another fine chapter in this excellent volume is that which deals with the normal and abnormal development of the lungs. The original work was done in cooperation with Dr. L. J. Wells and represents a long but necessary continuation of Streeter's fundamental work on pulmonary development. It might be of interest to surgeons and clinicians that in the human embryo at thirty-six days the bronchial buds corresponding to the prevailing adult lung pattern are already established and that subsegmental bronchial primordia appear at thirty-eight days. The time for development of abnormal patterns is prior to these stages.

The volume has 154 references to the literature. Technically, likewise, the book is well done. The great interest in this field, due to major advances in pulmonary surgery, is reflected in the recent appearance of two other volumes on the same general subject: *Anatomy of the Bronchial Tree* by R. C. Brock (second edition of a famous study) and *Anatomy of the Bronchovascular System* by G. L. Birnbaum. In overall quality the volume under revue yields to none.

ARNOLD A. ZIMMERMANN, M.D.

American Lecture Series, No. 246. Springfield, Ill.: Charles C Thomas, Publisher, 1955. Pp. 128, with 2 illustrations.

This small monograph on normal labor is a twenty-five-year clinical research investigation applied to normal obstetrics. The author clearly states his conviction that the

first stage of labor is simply the relation of frequency and intensity of the uterine contraction to the resistance offered by the cervix. He calls attention to the fact that at the height of a contraction, the resistance of the cervix can be determined vaginally. If dilatation is sufficient, the tight upper cervical lip can be retracted or slipped over the occiput. This method hastens the first stage of labor. Calkins maintains that the duration of labor depends upon the consistency of the cervix.

The author has long taught that easy forceps delivery is unnecessary and that difficult forceps delivery is contraindicated. He is convinced also that the use of high midforceps is contraindicated and strongly urges obstetricians to deliver babies in the posterior occipital position without attempting internal rotation. In his opinion, this method insures less trauma to both mother and child.

He agrees that there are certain definite indications for episiotomy and states that it should be performed in all operative deliveries of primiparae and some multiparae.

Calkins points out that there is some correlation between the activity of the uterus in the second stage and its activity in the third stage but that, in view of the blood loss that occurs in the third stage, this correlation must not be relied on too implicitly. Another obvious fact frequently overlooked is that the first stage covers a matter of hours and the second stage a matter of minutes up to as much as an hour, while the third stage seldom exceeds a few minutes. The greatest alertness is therefore necessary until the behavior of the uterus in the third stage is definitely known.

Calkins is still of the opinion that manual removal of the placenta is indicated only when bleeding becomes alarming and/or when the third stage exceeds two hours (he states that he had not encountered such a case in the past several years). I am not wholly in agreement with this statement.

In general practice, according to Calkins, oxytoxics should be given at the delivery of the baby, perhaps sooner by those who have already learned how to manage a uterus and who know when it is in a sufficient state of contraction. In a hospital where students and interns must be taught, they have consistently not used oxytoxic drugs, except when especially indicated, until after the placenta has been delivered. Calkins states that intramuscular administration of ergotrate seems to be almost useless. More and more he is giving pitocin intravenously. He also expresses the opinion that pitocin, administered by intravenous drip, is valuable in the first and second stages of labor when indicated.

There has been some discussion as to whether the repair of episiotomy or laceration should precede or follow delivery of the placenta. Calkins states that when bleeding occurs during the second stage of labor the cervix is inspected immediately, before the delivery of the placenta or repair of the perineum. He is not in accord with routine inspection of the cervix; since he feels that following the above indications for cervical inspection, severe injury to the cervix will seldom be overlooked. They have only had one deep cervical laceration in 500 deliveries.

Resuscitation of the newborn is seldom necessary, according to Calkins, if the patient with a normal pregnancy has been properly managed during her labor. He states that 97 per cent cough and sneeze within five to ten seconds. Standing the baby on its head and "milking" the upper part of the respiratory tract of its fluid content is the best procedure if the child is in anything like normal condition. He has so seldom found it necessary to insert a tracheal catheter, that he has no clear idea of its real value.

Maintenance of body temperature and early administration of oxygen are most important. The author does not hesitate to give morphine for after-pains but pays careful attention to expulsion of clots from the uterus after one hour, as this goes a long way in preventing after-pains. He has not used stilbesterol to control mammary engorgement; in his experience, an ice bag plus the administration of codeine has been satisfactory.

In general, Calkins prefers regional over general anesthesia, whether by simple perineal infiltration or something more extensive. The saddle block technic suggested by Adriani and others has served him very well. He suggests that the possibilities of pudendal block anesthesia have not been sufficiently investigated. This anesthesia is particularly applicable by one who does not have a trained anesthesiologist available. He also recommends for inhalation anesthesia 25 per cent nitroxide and 75 per cent oxygen.

His experience with tuline has not been satisfactory even with the new device available for its administration. He has had no expe-

rience with ethylene and is not convinced from the literature that he should even try it. He cannot subscribe to the theory that a good surgical anesthetist is necessarily a good obstetric anesthetist; he still considers it highly important to train an obstetrician in proper obstetric anesthesia. He takes the attitude that labor is a physiologic process, but that it is capable of becoming pathologic more rapidly than is any other physical process and therefore requires not just watchful expectancy but constant and intense surveillance, as well as consideration and sympathy.

HARRY O. MARYAN, M.D.

Surgery of Face, Mouth, and Jaws. By Frank McDowell, James Barrett Brown, and Minot P. Fryer. St. Louis; The C. V. Mosby Company, 1954. Pp. 213 with 168 illustrations.

This book is a monograph originally published in "Lewis-Walters Practice of Surgery," by W. F. Prior Company, Inc. of Hagerstown, Maryland.

It is most desirable to have such an excellent book published separately, because it will reach more persons interested in this particular phase of surgery. As the authors state in the preface, this book was intended to be concise and compact, without any thought of being all-inclusive.

This reviewer must disagree with a statement made in the early pages — "Sialograms are not of much diagnostic value at the present time." Much can be learned from this type of examination. An excellent point stressed is the importance of correlating the clinical data with the laboratory observations.

This book is apparently intended for the general surgeon, the general practitioner, residents, interns and students. It covers the subject in a most concise manner, beginning with the examination of the patient, emphasizing special points in the examination, operating room procedure and preoperative and postoperative care, and describes various methods of general and local anesthesia.

It covers a multitude of clinical entities in such an excellent fashion that only details are omitted. The numerous diagrams, drawings, illustrations, and photographs are valuable.

The authors are surgeons of wide experience and have presented those methods of treatment which apparently have given them the best results. Neither the size of this book nor its intent permits the inclusion of the alternative methods of treatment which may find favor with some other well known surgeons in this specialty.

Sixty-five of the 207 pages of this book are well devoted to traumatic injuries of the face and jaws. Much has been said in so short a space. The authors have drawn admirably from their extensive experience.

The section on congenital anomalies presents an excellent panoramic review. The authors recommend closing the cleft palate defect at the age of about 18 months. There are many men in the field of cleft palate surgery, however, who prefer the child to be 4½ to 5½ years of age, because of developmental features. With regard to speech therapy for these children, many surgeons prefer to start training very early—even at 2 to 2½ years. There are many phases in the therapy of cleft palate that are controversial at present.

The section on benign tumors of the face discusses not only all the more common growths but related dermatologic conditions that are not neoplastic, such as the port wine stain, senile keratoses and radiation dermatitis.

In such a book as this, discussion of malignant tumors of the face, mouth, and jaws must be limited, but the authors have stressed, much to their credit, the question of neck dissection—reasons, criteria, type and when indicated; also the time at which this operation should be done.

This is an excellent book and is highly recommended.

CASPER EPSTEIN, M.D.

Everybody likes and respects self-made men. It is a great deal better to be made that way than not to be made at all.

—*Emerson*

Abstracts from Current Literature

Syme's Amputation. Shelswell, J. H., Lancet 2:1296, 1955.

The author discusses the controversy that has existed as to the merits of the Syme amputation since its introduction in 1843. The paper is a statistical report of results.

Of over 25,000 amputations, Syme amputation accounted for 534, or 2 per cent. Of these, 302 patients had undergone 305 amputations that were sufficiently old for follow-up study; that is, they were performed prior to the period from 1935 to 1939.

The indications for amputation were routine, largely war and civilian injuries. There were 28 immediate failures, largely due to infection. This left 277 amputations for study, all fifteen or more years old.

Of the 277 amputations 45 became unsatisfactory, and reamputation was necessary. Vascular insufficiency was the main cause and came on with remarkable regularity after some twenty years. After elimination of the immediate fractures there was a 16.4 per cent reamputation rate. Sixty-six per cent had satisfactory Syme stumps. It was not considered a satisfactory procedure for the female patient.

PAUL W. SHANNON, M.D.

A Conservative Method of Resecting the Internal Mammary Lymph Nodes En Bloc with Radical Mastectomy. Ariel, I. M., Surg., Gynec. & Obst. 100:623-630 (May) 1955.

As to increasing the salvage rate among patients with carcinoma of the breast, it is the author's opinion that the defeatist attitude should be deplored. A method of internal mammary lymph node excision is presented as a compromise between the less radical internal mammary dissections and the more extensive internal mammary resection as practiced by Urban. The operation proposed by the author permits resection of the internal mammary chain *en bloc* with the breast, permits repair of the chest wall primarily and does not subject the patient to an increase in morbidity. The closure of the skin defect incident to the mastectomy is facilitated. The principal of the operative technic propsed by the author is conservative resection of the chest wall, especially that portion contiguous to the internal mammary vessels.

The technic of the surgical procedure is presented in detail and illustrated by excellent drawings.

The necessity of resecting the internal mammary chain of nodes in an effort to increase the salvage rate is dictated by the high incidence of metastases from cancer of the breast to the internal mammary lymph nodes. Including these nodes in the procedure of radical mastectomy permits removal of two primary sites of neoplastic spread. Unlike the radical operative procedures recommended by Wangensteen, in which attempts are made to remove secondary and tertiary lymph node deposits, the inclusion of the internal mammary chain mererly completes the radical mastectomy described by Halsted.

This operation, it is hoped, will increase the salvage rate somewhat by removing the nodes first invaded by medial breast cancer. Time alone will tell whether the hoped-for results are obtainable by this method.

M. O. CANTOR, M.D.

The Effects of Interruption of the Inferior Mesenteric Artery and its Branches on the Blood Supply of the Terminal part of the Large Gut in the Experimental Animal. Braithwaite, J. L., Surg., Gynec. & Obst. 100:521-531 (May) 1955.

Investigations were carried out into the effects of interrupting the inferior mesenteric artery and its branches. The purpose of this study was to determine the effect of such ligation upon the blood supply of the left side of the colon. The recent trend in operative technic for carcinoma of the rectum and rectosigmoid in which the inferior mesenteric artery is ligated furnished the impetus for this experimental study.

Although the author points out that the blood supply to the colon of the rat and that of the human being differ, certain points of similarity exist and permit some deductions to be made.

The experiments show that, if the blood supply from above is cut off, the middle rectal artery can undergo considerable en-

largement and afford a collateral supply to the lowermost part of the hindgut. This result supports partially the views of Ault, Castro and Smith, as well as those of Goligher, as to the safety of ligation of the inferior mesenteric artery in the performance of left colectomy. The results of Braithwaite differ, however, in that the middle hemorrhoidal artery increased markedly in size. In the studies of Ault the middle hemorrhoidal artery was sacrificed and reliance was placed upon the inferior hemorrhoidal artery for a collateral blood supply with the marginal artery. In Braithwaite's study no additional contribution of the inferior rectal artery was noted. This was explained as probably due to the capacity of the more proximal middle rectal artery to compensate for the ischemia.

M. O. CANTOR, M.D.

Extraluminal Mediastinography as an Aid in the Diagnosis of Mediastinal Disease. Berman, J. K., Judy, H. E., Mori, V., and Tosick, W. A., West. J. Surg., Obst. & Gynec. 63:169-176 (Apr.) 1955.

As a result of reviewing 169 cases of mediastinal disease, the authors observed that extraluminal pathologic change in this area often is not suspected and as a result is not diagnosed. Because of this observation, a search was made for additional diagnostic methods in an effort to increase the percentage of correct preoperative diagnoses.

The method reported is the use of extraluminal mediastinographic study. This method consists in injecting a contrast medium, such as 35 per cent diodrast, into the posterior mediastinal space and the anterior mediastinal spaces. Similar injections are also made in the superior mediastinal space. Although the number of cases in which this method has been tried is too few in number to permit definitive conclusions, the following information may be made available by this method:

1. The contour of the normal or abnormal mediastinum can be noted.

2. Tracheal or bronchial tears or lacerations can be found.

3. Extraluminal extensions from the esophagus, bronchial tree or great vessels can be noted.

4. Mediastinal lesions which have no intraluminal connections are readily visualized.

5. If an intraluminal contrast medium is used, silhouettes of normal and abnormal structures are clearly delineated.

6. Communications beneath the diaphragm can be found.

As a result of their experimental and clinical studies, the authors conclude that mediastinographic investigation may have a useful place as an additional diagnostic aid in the study of mediastinal disorders.

M. O. CANTOR, M.D.

The Jugular Body and Its Tumour. Birrell, J. H. W., Australian & New Zealand J. Surg. 24:195, 1955.

"Tumor formation" has now been described as occurring in most of the nonchromaffin paraganglia, one of the most recenly recognized tumors being that arising from the *glomus jugulare*.

In 1941 Guild stated: "Human temporal bone sections reveal structures in several respects like the carotid body for which the name *glomus jugularis* is proposed.

"Each glomus, wherever located, consists of blood vessels of capillary calibre with numerous epithelioid cells between the vessels."

This author observed that all bodies had a similar glomerular structure and consisted, in section, of a number of endothelium-lined fine vessels separated by a small amount of collagen tissue and large epithelioid cells with round or ovoid nuclei.

The symptoms of these tumors reflect the scattered distribution of the constituent portions of the jugular body.

Biopsy is dangerous; hence, roentgen examination assumes great importance in diagnosis and prognosis.

It is somewhat more difficult to assess the pathologic status of this type of tumor than to assess that of the carotid and vagal body. By virtue of their site of origin they are much more difficult to treat surgically and therefore to remove completely. Their pathologic nature, well-differentiated structure, lack of mitoses, slow growth, encapsulation and lack of distant blood-borne metastases are points that indicate a hyperplastic rather than a neoplastic process.

With regard to treatment, it can be stated at the onset that no specific line of therapy has yet emerged.

If the tumor is considered a hyperplastic

process affecting some or all of the constituent portions of the jugular body, complete surgical removal, as in the case of the carotid body, will be curative. The main difficulty lies in the great number of anatomically important structures in this area, but a further difficulty lies in the fact that most patients show roentgen evidence of bone destruction when first examined, and this indicates almost certain irreparable damage to various structures, such as nerves.

One procedure that has been valuable in eliminating a bruit that troubles the patient is ligation of the external carotid artery. It is possible that this may also retard the growth of the tumor or even cause some regression.

WILLIAM E. NORTH, M.D.

The Scope and Fate of Homologous Vascular Grafts Used for Bridging Aortic Defects. Bhatt, P. A.: Indian J. Surg. 16:223, 1954.

Forty grafting experiments have been done, under strict aseptic conditions, on healthy adult mongrel dogs. Grafts were obtained from animals which had been killed and their blood banked for the grafting operations.

For storage, a modified Gross's solution was used, consisting of balanced electrolytes with 10 per cent homologous serum, penicillin and streptomycin. Sterile sealed flasks were used, and storage was at 4 C. Broth cultures were made periodically from samples of the fluid; evidence of contamination eliminated that graft.

Ten grafts were placed in gaps produced in the abdominal portion of the aorta below the renal vessels, through an extraperitoneal approach. Anastomosis was accomplished by a continuous, over-and-over No. 5 O Anacap silk suture on an atraumatic needle. Heparinized saline solution in a syringe was used to flush the anastomosis at intervals during the procedure.

Thirty grafts were placed in gaps produced in the thoracic portion of the aorta.

In 7 animals grafts were inserted which necessitated clamping the aorta for thirty minutes or more.

In 21 dogs the following method was devised to maintain blood flow through the aorta during the major part of the procedure: The graft was threaded on a suitable length of polyethylene tube, smoothed at the edges and grooved at the ends, and the ends of this tube were fed into the free lumen of the divided aorta. A modified nasal snare carrying heavy silk was quickly slipped around the tube and graft, passed over the fringe of the host aorta and tightened over the indwelling polyethylene tube at the grooved ends. After removal of the aortic clamps the blood flow was established across the aortic defect via the tube, and the anastomosis could be carried out as usual and at leisure. After one end had been fully anastomosed and the other about two-thirds anastomosed, the aortic clamps were reapplied and the polyethylene tube removed, the graft flushed with heparinized saline solution, the anastomosis completed and the aortic clamps removed. The fate of the graft was studied by (a) tests of the distal femoral pulsations, (b) retrograde aortographic study and (c) necropsy. Material for histologic study of the graft was removed at three stages: (a) at the time of collection of the graft, (b) at the time of grafting, and (c) at necropsy.

Leakage was the most important complication.

Some grafts were used after two to thirty-seven days of storage. No definite relation was noted between the changes in the graft and the duration of storage.

Aneurysm occurred in 2 of the dogs; 1 died of leakage (caval graft in the thoracic portion of the aorta). The rest showed no aneurysms, and aortographic studies of the animals surviving have shown no aneurysmal changes.

The fate and patency of these grafts have been studied for periods varying from one week to one and a half years. The mortality rate attending abdominal grafts is low, but for grafts high in the thoracic portion of the aorta it is greater. Venous grafts are less suitable for repair of aortic defects than are arterial grafts.

WILLIAM E. NORTH, M.D.

A New Anatomic Guide for Safe Ligation of the Cystic Artery. Ramirez-Flores, R., Surg., Gynec. & Obst. 100:633, 1955.

It is recommended that in case of arterial hemorrhage, the free border of the gastrohepatic ligament be grasped between the thumb and index finger of the surgeon's right hand to control the hemorrhage and permit exposure for identification of the bleeding vessel.

Because of the inconsistent origin and course of the cystic artery, the author sought

another reference point—the arrival of the cystic artery at the neck of the gallbladder. It was observed that the cystic artery consistently enters the gallbladder at the level of the neck. In cases of acute cholecystitis or empyema of the gallbladder in which the anatomy of the region is obliterated by adhesions, it is difficult not only to identify the junction of the body of the gallbladder (including the neck) but to determine its relation to surrounding organs. "In the attempt always to find the neck by careful dissection," says the author, "I have encountered an anatomic organ of variable size, from 0.5 to 3 cm. in length, which corresponds to the cystic gland. As these observations were continued in the search for the entrance of the cystic artery, I became more familiar with the cystic artery, especially in those cases of 'obliterated anatomy' in which the only identifiable guide to the cystic artery was the cystic gland. Therefore, I emphasize the correlation of the cystic gland with the cystic artery."

In 47 cadavers the following observations were made: The cystic gland was always found in the angle between the neck and body of the gallbladder, and in 75 per cent of cases the cystic artery entered beneath the superior pole of the gland. In 15 per cent the cystic artery entered to the left of the gland; in 5 per cent it entered 2 or 3 mm. to the right of the gland, and in the remaining 5 per cent it entered on the right side, coursed across the neck and arrived at the right side of the gland, or an accessory artery approached from behind. Except in 1 case, the distance from the gland to the artery was less than 5 mm. In this exception the cystic artery, the point of origin of which was the superior mesenteric artery, entered the gallbladder 1.5 cm. from the cystic gland.

The divisions of the cystic artery, anterior, posterior, or inferior and superior, nearly always occurred at the inferior pole of the gland. In only 4 per cent of cases did divisions occur before it reached the gland. These statistics were confirmed in 100 operative cases.

WILLIAM E. NORTH, M.D.

Treatment of the Postphlebitic Syndrome (Tratamiento Del Sindrome Postflebitico). By Jorge McCook, J., and Navarrete, G., Angiologia 1955, 7:1, 1955.

The authors have made an intensive study of 30 cases showing the chief complications of the postphlebitic syndrome, namely dermatitis and ulcers of the leg. They were discouraged with the conservative treatment of Luke and the poor results that followed. The results obtained by previous surgical attacks were equally discouraging. They were constantly aware of Leriche's admonition that a patient with chronic phlebitis is a burden to himself and the world about him.

They decided that an audacious surgical approach to the problem would give the best results. In their opinion, there are two types of cases in which two distinct types of treatment are demanded. If there was only afternoon edema, the patients were treated conservatively; the others were treated operatively by resecting 10 cm. of the superficial femoral artery below the entrance of the deep femoral artery and completely stripping, as much as possible, the internal saphenous vein. The remaining segment of the internal saphenous was injected with sclerosing solutions.

In 2 of their cases there were disastrous results. In 1 they tied off the femoral artery instead of the vein, and in the other, as the result of periphlebitis and rough handling of the tissue, a vasomotor spasm of the femoral vein and artery ensued, with gangrene of the extremities.

In 22 cases, in 18 of which there were ulcers, they achieved the following results:

1. Closure of the ulcer in three weeks.
2. Complete disappearance of pain and dermatitis.
3. Persistence of induration and pigmentation.
4. Persistence of edema in 4 cases, requiring the use of an elastic stocking.

There is no doubt that the authors have made a sincere attempt to contribute knowledge of a very difficult problem.

S. A. GUEUKDJIAN, M.D.

Life is too short to be little.

—Disraeli